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THE THEORY OF HARMONY.

HANDBOOKS FOR MUSICIANS.

EDITED BY ERNEST NEWMAN.

THE
THEORY OF HARMONY

AN INQUIRY INTO THE NATURAL PRINCIPLES
OF HARMONY, WITH AN EXAMINATION OF THE
CHIEF SYSTEMS OF HARMONY FROM RAMEAU TO
THE PRESENT DAY.

BY

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THE REV. R. SANGSTER ANDERSON, M.A.,
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CONTENTS.

PART I.

PREFACE.

CHAPTER I.

	PAGE.
THE CONSONANCES of Polyphony: Figured Bass Schools and the Classification of Chords ...	1—28

CHAPTER II.

GIOSEFFO ZARLINO (1517-90) and the Generation of Harmony: Nature and Influence of his Work as a Theorist: René Descartes (1596-1650) (<i>Compendium Musicae</i> , 1618)	29—62
--	-------

CHAPTER III.

JEAN PHILIPPE RAMEAU (1683-1764): <i>Traité de l'Harmonie</i> : Harmonic Generation and the Inversion of Chords: The Minor Harmony: Origin of the Theory of Chord Generation by means of Added Thirds: Chords of the Seventh: Chords by "Supposition": Resolution of Dis- sonances: <i>Résumé</i> of Rameau's Theories of Chord Generation	63—97
---	-------

CHAPTER IV.

RAMEAU'S <i>Traité de l'Harmonie</i> (continued): The Fundamental Bass: The Cadence: Nature and Functions of Chords: Determination of "Key": Necessity for Dissonance in Music: Melody has its Origin in Harmony: The Nature and Constitution of the Scale	98—133
--	--------

PART II.

CHAPTER V.

RAMEAU'S <i>Nouveau Système de Musique Théorique</i> : Relationship of Harmony and the Fundamental Bass to Mathematical Pro- gressions: Theory of the Subdominant: The Major and Minor Modes: The Chromatic Scale: Nature and Origin of Tone-Systems	134—154
---	---------

CONTENTS.

CHAPTER VI.

PAGE.

RAMEAU'S <i>Génération Harmonique</i> and <i>Démonstration du Principe de l'Harmonie</i> : Harmony a Physico-Mathematical Science: Objections to Rameau's Theories by Berlioz, Fétis, and others	155—181
--	---------

CHAPTER VII.

RAMEAU'S <i>Génération Harmonique</i> and <i>Démonstration (continued)</i> : The Diatonic System (Major Mode): Harmonic Dissonance: 'Double Employment' of Dissonance: Chord of the "Added Sixth": Examination of Rameau's Views concerning the Origin and Nature of the Key-System: Difficulties in Connection with the Subdominant: Helmholtz's Theory of the Origin of Scales: Difficulties Connected with the Tritone: Chord of the "Added Sixth": "False Intervals" of the Scale: Temperament, its Theory and Practice	182—218
---	---------

CHAPTER VIII.

RAMEAU'S <i>Génération Harmonique</i> and <i>Démonstration (continued)</i> : The Minor Harmony: The Minor Mode: Further Development of Rameau's Views respecting the Minor Harmony: Relationship of the Major and Minor Modes: Anticipation of Helmholtz's Theory of the Minor Harmony: the Chromatic Genus: Origin of the Chromatic Scale: the Enharmonic Genus: the Use made of Quarter-tones in Modern Music: Other Aspects of Rameau's Theory	219—254
---	---------

CHAPTER IX.

OTHER Theoretical Works of Rameau: <i>Code de Musique Pratique</i> : <i>Nouvelles Réflexions sur la Démonstration du Principe de l'Harmonie</i> : <i>Nouvelles Réflexions sur le Principe Sonore</i> : The Minor Harmony: The Subdominant: Generation of the Major Mode: Origin of Dissonant Chords: Contemporary Criticism of Rameau's Doctrines: Rameau and the "Encyclopædists"	255—285
--	---------

CONTENTS.

PART III.

CHAPTER X.

PAGE.

DEVELOPMENT of the Theory of Harmony from the time of Rameau up to the present day: Tartini's *Trattato di Musica* (1754): The Principle of Harmony is independent of human will: Resultant Tones: Physical Root of the Harmonic System: The Arithmetical as well as the Harmonic Division of the Octave, and of the Fifth, is a necessity of the Harmonic System: The Minor Harmony arises from the same Principle as the Major: Origin of the Key-System: Origin of Harmonic Dissonance.

G. A. SORGE (*Vorgemach der Musikalischen Komposition*, 1745-47): Generation of Chords: Theoretical Importance of Chord of the Dominant Seventh.

F. W. MARPURG (*Systematische Einleitung in die musikalische Setzkunst*, 1757, *Handbuch bei dem Generalbasse und der Composition*, 1755-58, etc.): Development of the Added-Third Theory of Chord Generation: Chords of the "Ninth," "Eleventh," and "Thirteenth": Sorge and Marpurg on the Origin of the Chord of the Diminished Seventh

286—316

CHAPTER XI.

J. P. KIRNBERGER (1721-83): Reaction against Marpurg's doctrines: Significance of the Leading-note: All Harmony comprised in the Triad and Chord of the Seventh: "Essential" and "Non-essential" Discords: Origin of the Chord of the Augmented Sixth.

Other Theorists of the end of the 18th and beginning of the 19th centuries: P. J. Roussier: Abbé Vogler: G. Weber: L. A. Sabbatini: C. S. Catel, etc.

F. J. FÉTIS (1784-1871) and the Doctrine of Tonality: The "Laws" of Tonality; Change from the Old to the New World of Harmonic Music brought about by Monteverde's introduction of the Chord of the Dominant Seventh: The Chord of the Dominant Seventh a Natural Discord: Chord Relationship and Succession: "Altered" and "Chromatically Altered" Chords

317—351

CONTENTS.

CHAPTER XII.

PAGE.

MORITZ HAUPTMANN (1792-1868) and the Nature of Harmony: Rejection of the Partial-tone Theory: The real Basis of Harmony: Octave, Fifth and Major Third the only "directly intelligible" Intervals: The Key-system: Secondary Triads of the Key-system: Origin of Discords: Diminished Triads and the Chord of the "Added Sixth": Resolution of Dissonant Chords: The Chromatic Scale: The Minor Harmony: Chord Relationship and Succession.

H. L. F. HELMHOLTZ (*The Sensations of Tone*, 1863): The Major Harmony: Minor Harmony and the Chord of the "Added Sixth": Origin of Dissonant Chords: Tonality: Theory of Consonance and Dissonance.

OTTINGEN and the Dual Nature of Harmony.

DR. H. RIEMANN (*Die Natur der Harmonik*, 1882; *Harmony Simplified*, 1893, etc.): The "Under-tone Series": The "Tonal Functions" of Chords: "Overklänge" and "Underklänge": The Key-system: Characteristic Discords: Parallelklänge: Melodically altered Chords: Chord Succession 352—410

CHAPTER XIII.

ENGLISH THEORISTS: Day's *Treatise on Harmony* (1845): Diatonic and Chromatic Harmony: The Key-system: Natural Discords: Day's Fundamental Bass: System of "Roots": Minor Harmony and Minor Mode: The Subdominant: The Augmented Triad.

MACFARREN'S *Rudiments of Harmony* (1860) and *Six Lectures on Harmony* (1867).

OUSELEY'S *Treatise on Harmony* (1868).

STAINER'S *Theory of Harmony* (1871): The Tempered Scale: Added Third Generation of Chords: The Third "The Basis of all Harmony."

E. PROUT (*Harmony: its Theory and Practice*, 20th ed., 1903): Resuscitation of Day's Theory: Subsequent Abandonment of the Harmonic Series as the Basis of Harmony: Origin of Discords: the Subdominant: Secondary Discords: Chord Succession: "Tonality" and the "Melodic Tendencies" of the Sounds of the Scale 411—452

CHAPTER XIV.

RÉSUMÉ and Conclusion 453—484

PREFACE.

THE present work might be described as, to some extent, a contribution to the history of the theory of harmony. Notwithstanding the extensive and highly specialized literature which we possess, dealing with the history and the art of music, a literature which of late years has been enormously enriched, comparatively little attention has been given to the history and development of the theory of harmony, which, ever since the time of Rameau, has been considered by musicians themselves to be intimately connected with the art of music. Coussemaker's *Histoire de l'harmonie du moyen-âge* has to do with the history of the art of music during the Middle Ages, rather than with its theory. The *Esquisse de l'histoire de l'harmonie* of Fétis is a real history of harmonic theory, and of harmonic systems. But it is, from various points of view, inadequate. It would be quite impossible, for example, to gain from the *brochure* of Fétis any real acquaintance with Rameau's theoretical achievements, or the nature of his researches in the domain of harmony: while Zarlino is dismissed with the remark that "he is unable to present to us any synoptic science of chords"! With regard to Dr. Riemann's important work, *Geschichte der Musiktheorie im IX.-XIX. Jahrhundert*, it is evident that its author does not consider it to be a history of the theory of harmony, since he makes no attempt even to summarize the systems of such distinguished theorists as Tartini, Hauptmann, and Fétis, as well as of other theorists.

The real object of the present work, however, is not to give a mere colourless exposition of the most important and

representative systems of harmony, but rather to ascertain, as far as possible, what constitutes the true basis of a theory of harmony, and especially whether, or to what extent, harmony can properly be said to have a physical basis. Ever since the time of Pythagoras, music and harmony have been related to mathematical science. But in all times there have also been found theorists who were sharply opposed to the view that the underlying principles of harmony are natural or mathematical principles. The art of harmony, they have contended, rests not on physical, but on metaphysical principles: music, they point out, is the expression of man himself, that is, it is man-made, and has nothing to do with anything external to man, nor, especially, with any natural phenomena, acoustical or otherwise.

It was *Jean Philippe Rameau* (born 1683 at Dijon, died 1764 in Paris), the famous musical theorist, and one of the most distinguished composers of his time, who first proposed a theory of harmony based on acoustical phenomena. Rameau made it his principal task to demonstrate, not only that all music, whether melodic or harmonic, is governed by certain laws, but that these laws are derived from "natural principles," which, he endeavoured to prove, reside in musical sound itself, and are neither more nor less than the natural relations which may be observed to exist in a sonorous body capable of producing an appreciable musical sound. Rameau was followed by the scarcely less distinguished Italian theorist and composer Giuseppe Tartini (1692-1770), who, working independently, nevertheless arrived in his *Trattato di Musica* at results which, in the main, were strikingly similar to those obtained by the illustrious Frenchman. Since the latter part of the eighteenth century, and up to the present day, a vast number of works on harmony have made their appearance, in which the theory of harmony is related to acoustical phenomena. In these we find attempts to develop still further the theories of Rameau, or to evolve fresh theories. F. W. Marpurg (1718-1795), for example, the author of what he termed the *Rameau-Marpurg System*, exerted himself to remedy, as he imagined, the principal defects of the Rameau system, to bring it "up-to-date," and to provide the musical world with a good working and practical theory of harmony. The distinguishing features of such works on harmony by the successors of

Rameau, are, undoubtedly, the extraordinary exploitation of the harmonic series for the purposes of scale and chord generation, and the no less extraordinary development of the theory of chord formation by means of added Thirds.

On the other hand, there appeared works whose most conspicuous feature was the definite abandonment of the harmonic series as a principle of harmony. These, and especially the writings on harmony of J. P. Kirnberger (1721-1783), may be regarded as being, in a sense, a protest against such theoretical absurdities as those presented in the *Rameau-Marburg System*. But even in works on harmony by some of the most eminent theorists and musicians of their time, we find the opinion, expressed with the utmost emphasis, that a rational theory of harmony based on acoustical phenomena is impossible. Witness, for example, the *Traité de l'harmonie* of Fr. J. Fétis (1784-1871), and the *Harmonik und Metrik* of Moritz Hauptmann (1792-1868). In this country, the well-known system of harmony of Dr. Alfred Day has long held a foremost place, notwithstanding that it was vigorously opposed by such a musician as Sir John Stainer, who himself proposed a new "theory of harmony based on the tempered scale." Of late years, however, the Day system has fallen into discredit: at least the number of those who still place their faith in it is daily diminishing. The late Professor Prout, who at first closely adhered to Day's system of harmony, finally discarded acoustical phenomena as the basis of the theory of harmony, without, however, being able to find for it any other adequate basis, or to evolve any independent theory. The examination of the numerous works in existence which treat of the theory of harmony reveals the fact, not only that these tend to contradict each other, but that they exhibit, more frequently than not, decided inner contradiction, as well as contradiction with the facts of musical experience. It is not surprising that at the present day the greatest uncertainty and misgiving exist, not only with respect to the theory of harmony itself, but even as to what constitutes the proper basis of such a theory.

Nevertheless, it need hardly be said, the results of the strivings of generations of musical theorists by no means represent so much time and labour wasted. Their researches have already borne fruit, and are destined to bear, we believe,

much greater fruit. At any rate, these researches no student of the subject can possibly afford to neglect.

In our examination, in the present volume, of the various important works which treat of the subject of harmony, much prominence has been given to the theoretical works of Rameau, who is generally spoken of as having "laid the foundations of the science of harmony." Rameau was a real theoretical genius. He was not only one of the greatest theorists of his time, but one of the greatest of all the theorists who have at any time endeavoured to elucidate the mysteries of harmony, and to discover its laws. In his own day, he was acclaimed as the "Newton of harmony." Before many years had passed, however, his theories began to be considered as inadequate, and insufficient for the explanation of the many new harmonic combinations which had been sanctioned by the practice of composers of genius. His system of the fundamental bass, regarded by his contemporaries as his greatest theoretical achievement, was judged to be out-of-date. Ed. J. Fétis, in his *Esquisse de l'histoire de l'harmonie* (1840), as well as in his *Traité de l'harmonie*, made a severe attack on Rameau's system. He asserted that Rameau, in his theory of chord generation, had totally disregarded the principle of Tonality, that the chords thus generated appeared as isolated entities, destitute of connection. In order to remedy these defects, he had invented his fundamental bass. This bass, however, was itself arbitrary and irrational; its rules, further, were insufficient for a multitude of cases, and its defects had become more and more apparent since a great quantity of strange harmonies, unknown in Rameau's time, had been introduced into music. Finally, his theory of "double employment" (*double emploi*), and his pretended fundamental chord of the "Added Sixth" were sufficient to destroy his theory from top to bottom.

After this onslaught of Fétis, than whom few wielded greater influence as a musical critic, historian, and theorist, nothing appeared to be wanting in order to consign Rameau's theory finally to oblivion. Nevertheless, we find Helmholtz in his work, *The Sensations of Tone* (1865), making use of Rameau's principles in connection with his own theories, not without acknowledgment of the great value and importance of Rameau's theoretical researches and discoveries. He thinks, with Rameau, that harmony has a physical basis;

he commends "his fine artistic feeling," which so "fully corresponded with the facts in nature": he energetically supports his theory of "double employment," and with respect to the chord of the "Added Sixth," thinks that Rameau has a much clearer insight into the nature of this chord than the great majority of modern theorists. The ghost of the "fundamental bass" peers out from many a page of Helmholtz's work. Rameau's influence has been widespread and powerful, and even those who have rejected his doctrines have not hesitated to borrow his principles.

But most remarkable of all, and a striking testimony to Rameau's importance as a theorist, is the fact that certain of Rameau's doctrines, which have been long neglected, or misunderstood and even ridiculed, are, in our own day, springing into new life. Thus Dr. Riemann, in his work, *Harmony Simplified, or Theory of the Tonal Functions of Chords* (1893), has not only utilized certain of the most essential of Rameau's doctrines, and, in particular, the fundamental bass, as the foundation of his system, but has made a notable attempt to develop them. Dr. Riemann's work might well be described as the apotheosis of Rameau's fundamental bass. In the face of these facts, it would be rash to assume, like Fétis, that Rameau's works are antiquated, or that they possess little significance for present-day theory.

But notwithstanding Rameau's great importance as a theorist, no adequate exposition and examination of his theoretical researches, embodied in his numerous works on harmony, have ever been given, whether in this or in any other country. The only work of Rameau which has been translated into English is the third book of his *Traité de l'harmonie*, the least important, from the point of view of harmonic theory, of all the four books comprised in the *Traité* and from which alone it would be quite impossible to acquire any adequate knowledge of the nature of the theoretical principles contained in this, the first, of Rameau's works on harmony. But even the most complete acquaintance with all the books of the *Traité* would not entitle us to assume that we were familiar with Rameau's theory of harmony. Rameau has embodied the results of his reflections on the subject, not in one only, but in several important theoretical works, a fact not always remembered by his commentators. His ideas on the subject of harmony were

in a state of constant flux, and of continuous development. For this reason it would be a somewhat difficult task to give a synopsis of Rameau's theories on half a sheet of note-paper. The explanation of the minor harmony, for example, given in the *Traité* is essentially different from that given in the *Génération Harmonique*; while, in his *Démonstration du Principe de l'harmonie*, Rameau's ideas on the subject have undergone still further development, and he in effect there anticipates that explanation of the minor harmony which is generally attributed to Helmholtz.

For a similar reason it has been thought proper to deal with Rameau's works separately. Such a method has, besides, other advantages. It is instructive to trace the gradual development of Rameau's ideas; while the nature of the problems which arise, and the difficulties which attend their solution, are more adequately realised, and more clearly understood. On the other hand, the attempt to give an exposition of Rameau's theory as a whole could only lead to inadequate and even false conceptions with respect to his work as a theorist. An exposition of this kind would be noteworthy, not so much for what it contained, as for what was necessarily omitted. Such a work is d'Alembert's *Elements de Musique suivant les Principes de M. Rameau* (1752), which is frequently described as a concise and lucid exposition of Rameau's theory of harmony. It is certainly the only exposition we possess worthy of the name. But in this work, d'Alembert has found it necessary to proceed by a process, not only of selection, but of elimination; he selects what he considers to be most important and essential, and eliminates the rest. The result is, that no adequate knowledge of Rameau's theoretical researches, nor just appreciation of his achievements as a theorist, can be gained from the perusal of d'Alembert's work.

In the present volume, we have given not only a complete exposition of the theoretical researches of Rameau, but have also subjected his theories to a careful examination. In the course of this examination fresh light has not only been thrown on certain important aspects of Rameau's theory, but results have been arrived at which, the writer believes, are of importance, not only with respect to Rameau's work, but for the theory of harmony in general. It might well be imagined, for example, that little or nothing remains to be

said in connection with such a well-worn theme as Rameau's theory of the inversion of chords, familiar, we may suppose, to every musician. But Rameau's title to be considered as the author of this theory has, especially of late years, been seriously called in question. It has been contended that this theory in reality originated with the figured bass practitioners of the seventeenth century. An attempt has been made in the present work to settle this question, with which are connected considerations of much more than merely historical importance. It is extremely doubtful whether, at the present day, the real significance of Rameau's theory of harmonic inversion is properly understood. Theorists appear, for the most part, to have overlooked the fact that Rameau's theory of harmonic inversion is inseparably bound up with his theories of harmonic generation and of the fundamental bass, and have consequently failed to appreciate the significance which such a fact possesses for the theory of harmony, and how it affects the question as to whether the theory of harmony has a physical basis. One curious result of this has been that theorists who, like Fétis, are totally opposed to the conception that harmony has such a basis, and who altogether reject Rameau's theories of harmonic generation, and of the fundamental bass, have nevertheless considered themselves at liberty to benefit from, and to utilise, his theory of harmonic inversion. In justification of such theorists, however, it may be remarked that Rameau himself did not perceive to anything like its full extent the great theoretical significance of his theory of harmonic inversion. Here Rameau "built better than he knew."

The theory of Rameau has its roots in the theoretical principles elucidated by Zarlino and René Descartes. To both these great men Rameau was indebted to an extent hitherto almost unsuspected. But the origin of Rameau's theory may be traced much farther back than Zarlino. Several centuries before Christ, the Greeks made the discovery (attributed to Pythagoras) that the Consonances or harmonies of the Octave, Fifth, and Fourth, which formed the basis of their musical system, could all be expressed by the ratios $1 : 2$, $2 : 3$, and $3 : 4$, or, more accurately, corresponded exactly with the determinations given by these ratios. This represents—although to many it may appear a startling statement—the first solid achievement in musical theory which led

directly to the fundamental principle of harmony of Zarlino, Descartes, and Rameau. In these facts elucidated by the Greeks, Gioseffo Zarlino (1517-1590) discovered a definite principle of harmonic generation, and, adding to the consonances of the Greeks the major and minor Thirds, which by his time had been recognised as consonant, he demonstrated (although the minor Sixth proved a difficulty) that all the consonances, which formed the sole constitutive elements of polyphony, were comprised in, and generated from, the *senario*, or arithmetical series of numbers 1 : 2 : 3 : 4 : 5 : 6.

The *senario* of Zarlino formed the starting point for Rameau in his theoretical researches : it was his principle of harmonic generation ; of the fundamental bass ; the foundation for his theory of harmonic inversion—his principle of principles. After the publication of his *Traité de l'harmonie* he discovered, to his inexpressible astonishment, that this principle was not merely a mathematical but a natural principle. Harmony actually existed in nature : it had its source in musical sound itself. These facts are suggestive. As is familiar to every reader of Helmholtz's *Sensations of Tone*, the circumstances relating to the mathematical determination of the consonances are exhaustively investigated by this distinguished scientist. Helmholtz, like Pythagoras, is of opinion that the Octave is determined by the ratio 1 : 2, and the Fifth by the ratio 2 : 3, and is by no means prepared to allow that the Greek theory of determination of the consonances of the sixth century B.C. has no significance for the theory of harmony of the nineteenth century A.D.

The researches of Zarlino are, in themselves, of extreme importance, not only for the theory of music in general, but for the theory of harmony in particular. Zarlino's position as a theorist, and especially the bearing which his researches have on the theory of harmony, have never been properly determined. Dr. Riemann, in his *Geschichte der Musiktheorie*, has credited Zarlino with certain extraordinary discoveries, and arrives at certain conclusions regarding Zarlino's work as a theorist which are by no means borne out by the facts. At the same time, he has overlooked some of the most significant of Zarlino's theoretical achievements. In the present work, an attempt has been made, not only to give an adequate exposition of Zarlino's theoretical principles, but to indicate clearly what he actually accomplished.

If Rameau owes much to Zarlino and Descartes, his influence on his successors, on the other hand, has been all-powerful. In tracing the influence of Rameau on his successors, it has been necessary to trace the development which the theory of harmony has undergone in every important work on the subject which has appeared since his time. The examination of these works by no means induces the opinion that they supersede the theories of Rameau, but tends rather to emphasise the value, even for present-day theory, of the work performed by the illustrious Frenchman.

The whole subject is one, not merely of musical, but of scientific and philosophical importance. It has a direct bearing on Esthetics and Psychology. When Rameau set out to penetrate the obscurities which surrounded the domain of harmony, he set out, it may be thought, on a somewhat Quixotic adventure, for his object was to demonstrate that music and harmony were based on natural principles, and on natural laws as invariable and steadfast as those which govern the planets in their courses. He may, at first, have expected too much from his science, and from the rules of composition which it enabled him to deduce. But he had too great an insight not to perceive that genius may transcend "the rules." He was not one of those who see in every new and startling development of human activity the threatened destruction of all the law and the prophets. Genius came, not to destroy the artistic law, but to fulfil it. The principle of harmony was independent of the human will. Music was not a mere play of sensations, having no better origin than human caprice, than the propensity of the human animal to sport. Truth and beauty were no vain chimeras. Even in his artistic endeavours, man, although he might imagine himself to be free, was nevertheless not left wholly to his own imaginings. He had, fortunately, a guide. The result of Rameau's researches was his conviction that he had discovered "the invisible guide of the musician," and that, left to his own devices, man might indeed attempt to build up artistic works, but in vain, because he had no foundation on which to build.

In his endeavours to demonstrate the truth of his principles, Rameau encountered serious difficulties. These difficulties none of his successors have been able to remove. It may be partly owing to this fact that theorists, at the present day, are forsaking acoustical phenomena, and turning towards

psychology for an explanation of the problems connected with harmony. But it should be noted not only that psychology has its own problems, but that psychologists are seeking in music and harmony (consonance) and its effects on the mind, for a solution of some of these problems. It may prove eventually that, instead of musical theorists finding their difficulties removed by means of the science of psychology, psychology itself will be advanced by means of discoveries made in the domain of the theory of harmony.

A word remains to be added in connection with the preparation of this work, which has entailed the careful examination and study of a very large number of volumes and treatises on the subject of harmony and its theory. It is a word expressing grateful acknowledgment of the courtesy of the library officials of the British Museum, and of the Music Class-room, University of Edinburgh.

THE THEORY OF HARMONY

CHAPTER I.

THE CONSONANCES OF POLYPHONY. FIGURED BASS SCHOOLS AND THE CLASSIFICATION OF CHORDS.

THE earliest examples of polyphonic music, which date from about the end of the ninth century, are based solely on the consonances already known to and recognized as such by the Greeks of the time of Pythagoras, namely, the Fourth, Fifth, and Octave. Soon other intervals made their appearance—dissonances, as well as imperfect consonances. The consonant nature of the latter was not at first perceived, or at least admitted, by writers on music, who were doubtless considerably influenced by Greek theory, but were described as Dissonances, and later as Imperfect Dissonances, that is, occupying an intermediate position between Consonance and Dissonance; ultimately they were recognized as Consonances.

It is instructive to note the different stages in the gradual evolution towards the complete theoretical recognition of the consonant nature of the Thirds and Sixths. Thus Franco of Cologne¹ groups the intervals into two main classes, Consonant and Dissonant.² The consonant intervals are of three kinds:—

Perfect— Unison and Octave.

Intermediate—Fourth and Fifth.

Imperfect— Major Third and Minor Third.

The dissonant intervals are of two kinds:—

Perfect— Semitone; Tritone; Major Seventh; *Minor Sixth*.

Imperfect—Major Second; *Major Sixth*; Minor Seventh.

¹ First half of thirteenth century: Fétis, in his *Biographie Universelle des Musiciens*, gives the date of Franco's activity as more than a century earlier.

² *Ars Cantus Mensurabilis*, Cap. XI. (Coussemaker, *Scriptores I.*).

On the other hand, the classification of the intervals given by the writer of the *Compendium Discantus*,¹ a contemporary treatise, is essentially different from that given above. He says: "There are six pure dissonances, namely, the minor Second, major Second, Tritone, minor Sixth, minor and major Sevenths. Of the consonances, three—the Unison, Octave, and Fifth—are in themselves perfect (*per se perfectae*); three are consonant by virtue of their relationship to perfect consonances, namely, major Third proceeding to perfect Fifth; minor Third to Unison; and major Sixth to perfect Octave." The perfect Fourth, although in itself consonant, has the effect of a dissonance; a statement which is noteworthy in so early a treatise. The minor Sixth was still for some time regarded as dissonant. The *Ars Contrapuncti secundum Johannem de Muris*,² written in the first half of the fourteenth century, treats the major Sixth as a consonance, but the minor Sixth as a dissonance. In a treatise³ which is appended to the above, however, the minor Sixth is placed on the same footing as the major; thus both the Sixths, as well as the Thirds, are ultimately recognized as imperfect consonances.

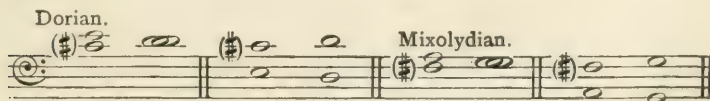
It is evident, then, that the practice of harmony of the early contrapuntists was largely a question of intervals; and this is true also of this entire period of polyphonic music. Thus the chord *c-e-g* was considered to arise from the union of the major Third *c-e* with the perfect Fifth *c-g*. The chord *g-c'-e'*, which we know as the second inversion of the chord *c-e-g*, could not, however, be employed except as a suspension, as it contained the dissonant interval *g-c'*, a Fourth. Comparatively early, parallel successions of perfect consonances, such as characterized the first attempts at polyphonic music, are prohibited; also the rules for the treatment of the various intervals are clearly defined. As a general rule it was laid down that an imperfect consonance should be followed by a perfect one; while a dissonance should be followed by a consonance.⁴ It is evident then in the second

¹ Ccussemaker, *Scriptores I.* ² Coussemaker, *Scriptores III.* ³ *Ibid.*

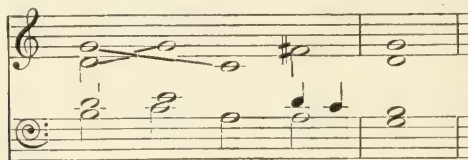
⁴ Thus Guilelmus Monachus (c. 1450) directs that the dissonance of the Second be followed by the consonance of the Third; the Tritone by the Fifth; the Seventh by the Sixth, and—a remarkable circumstance—the Fourth by the Third! The Fourth, a perfect interval, is *dissonant*, and requires to be resolved! (See also p. 23.)

place that the harmonic art of this period had, as its basis, *Consonance*. The consonances are the pillars of the harmonic structure; the dissonances, on the other hand, are notes of ornament, resulting from the figuration of the melody, or they are notes of suspension, as of the Third by the Fourth, of the Sixth by the Seventh, or passing-notes, etc. By the middle of the sixteenth century we find Zarlino treating of the inversion of intervals. Zarlino also attaches significance to the *bass* (not of course the Fundamental Bass as understood by Rameau, but the lowest note in every interval or chord, whether inverted or not) as the real support and foundation of the harmony. In the concluding Cadence, Zarlino directs that the bass proceed to the Final of the mode, whether the Tenor do so or not; here the Bass may descend a Fifth, or ascend a Fourth, to the Final, while the highest part, or at least one of the upper parts, proceeds from the semitone below the Final to the Final itself.¹ This corresponds in every way with our Perfect Cadence, which as we shall see is a fact of great importance for Rameau, and for the theory of harmony. The only harmonies generally practised during this epoch of polyphonic music which culminated in the works of Palestrina and Lassus, at the close of the sixteenth century, are those of the Third and Fifth; of the Third and Sixth; of the Third or Sixth and Octave; of the Fifth and Octave, or of the Third, Fifth, and Octave. At the same time the second inversion of the consonant major or minor harmony, that is, the Perfect Fourth combined with the major or minor Sixth, might be employed much in the same way as at the present day, as a suspension of the consonant triad on the same bass note. Occasionally also the combination of consonant intervals above a bass note with a suspension in one of the voices led to some extremely curious harmonic results, as in the following

¹ The semitone below the Final is required by Joh. de Muris as early as the fourteenth century, even in cases where it is foreign to the constitution and character of the mode, as in the Dorian and Mixolydian modes:—



passage from the *Gloria* of Palestrina's *Missa Papæ Marcelli* :—



At the third minim in the first bar, we find that the notes actually present are *a, c, e, g*. It is difficult to explain *g* as a non-harmonic note which merely retards the *f#* immediately following; for if *f#* be the real harmony note, then there results the harmony *a, c, e, f#*. In fact, the last three chords in this passage correspond to what we at the present day understand as the chord of the Seventh on the Supertonic, followed by a Dominant Tonic Cadence, in G major.

But, as is known, the music of this period is of a nature essentially different from that of a later time, and of our own day. What is the nature of this difference? We are frequently told that the older art, based as it was on the Ecclesiastical Modes, had its roots in *Melody*; that is, its harmony was the result of the concurrence of the various melodic voice parts. Our modern music, on the other hand, has as its foundation *Harmony*; melody, instead of being the determining factor, as was the case in the older art, is itself harmonically determined. As to this, one may say that the view that, in the music of the polyphonic period, harmony was determined as the result of the, presumably, fortuitous concurrence of the different melodies, is a very superficial one. The harmonies or consonances which at first formed the basis of polyphony, namely the Octave, Fifth, and Fourth, were known and their mathematical ratios (1:2, 2:3 and 3:4) even discovered by Pythagoras fourteen or fifteen centuries before polyphony was thought of. The Church Modes themselves depended for their definition on these same consonances. The Octave determined the compass of the mode; while the Fourth and Fifth were necessary for the division of the modes into Authentic and Plagal. The harmony of polyphony was not arbitrarily determined; on the contrary the melodies were shaped so as to produce a pleasing harmony. If in

monophonic music the individual melody was apparently able to pursue its own free unfettered course, this was no longer possible in a union or community of melodies. Nothing but chaos could be the result. Such a union was possible only when each melody, in seeming surrender of its liberty, and out of consideration for its neighbours and for the general well-being, so to speak, of the community of sounds, submitted itself to a certain guiding and immanent principle, and thus took its indispensable part in bringing about those immeasurably richer and grander artistic creations which form the imperishable glory of musical art. This guiding principle was Harmony.

For those who hold that the harmony of early polyphony had its origin in melody, it is a distinctly disconcerting circumstance that the composers of that time *altered* the Ecclesiastical Modes in order to obtain a proper harmony.¹ And yet these Modes had been consecrated by the traditions of centuries, and especially by their use in the sacred services of the Church. In short, the constitutive elements of the harmony of polyphony which Zarlino, the theorist *par excellence* of the polyphony of his time, has expressly stated to consist of nothing but the Perfect and Imperfect Consonances, are the constitutive elements of the harmonic art of our day. Our Perfect Consonances are, in every respect, the Perfect Consonances known to the Greeks of the time of Pythagoras. The art of music exhibits itself as an organism; and the history of music and of harmony is the history of a gradual, continuous, and consistent development. It is somewhat unphilosophical, therefore, to explain the harmony of the early polyphonic period as having its source in melody, but to maintain that in our modern music exactly the opposite is the case; that melody has its source in harmony, while harmony itself now becomes apparently inexplicable.

Still it remains true that the music of the early polyphonic period is in its nature different from that of more modern times. To the modern ear, the progression from harmony to harmony is determined by certain relation-

¹ Hence, in order to avoid the tritone, and to obtain a true Cadence, the use of the so-called *Musica ficta*, that is, alterations, by means of sharps or flats, expressed or understood, of the notes of the Ecclesiastical Modes.

ships existing between the harmonies themselves. It would be untrue to assert that in the older art harmonic relationship was non-existent—very much the reverse ; on the other hand, in its movement from consonance to consonance, and from harmony to harmony, we do not find that definiteness of harmonic significance, those principles of chord succession which especially gather up as in the music of a later time the whole harmonic material into a certain unity—the Key-system. This alone accounts in great part for the peculiar and characteristic effect of the older music.

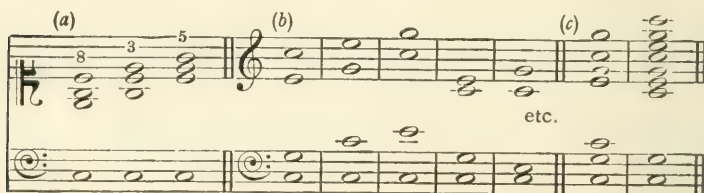
The change from the old art to the new is frequently assumed to have been accomplished at the beginning of the seventeenth century. This however is an assumption not altogether justified by the facts. The change which occurred was the result, not of sudden revolution, but of gradual development. Many influences had already been at work tending towards the overthrow of the old modal system. On the other hand, composers did not rid themselves so easily of the influence of established traditions, and our modern tone-system did not become finally fixed until much later than the first decade of the seventeenth century. But the gradual development and transformation of the Church Modes to the Major and Minor Modes of our own day, the beginnings of which can be traced back to a period even before the time of Palestrina, received a powerful impetus from the rise of accompanied monody towards the end of the sixteenth and beginning of the seventeenth centuries as well as from the invention, about the same time, of the *Basso Continuo* or thorough bass. This bass appears to have been devised for the sake of convenience in the accompaniment of polyphonic music in order to obviate the difficulty, on the part of the cembalist or organist, of reading a great many parts at one time. Unlike the vocal bass part, which was frequently interrupted, this instrumental bass was continuous, and represented always the lowest moving voice part ; hence the term *Basso Continuo*. This bass was made use of for the accompaniment of *Recitative*, which was the most characteristic feature of the new style which now arose.

The invention of *Recitative*, as is known, coincides with the rise of the Opera, and represents an attempt to resuscitate the musical declamation of the poetic text of

ancient Greek tragedy. For such a dramatic recitation, in which the natural accent and appropriate expression of the words were all important, the highly elaborate polyphonic music of the Church composers was rightly judged to be unsuited. The means towards this end was therefore sought for and found in a solo melody which should imitate the accents of speech—the Recitative. So great importance being attached to the words, it can be easily imagined therefore that the musical element in the first attempts at opera played a very subordinate part. Hence the accompaniment to the Recitative was of the simplest possible kind, consisting of a few chords serving as a harmonic support to the voice, which were indicated simply by a bass part—the Basso Continuo above mentioned. To this bass figures were added, and placed above the different notes of which the bass was composed ; these figures—from 2 up to 9, and even to 12 and 13—indicating the intervals, reckoned from the bass upwards, of the harmony to be employed. This Figured Bass it is evident was not a theoretical but a practical device, a kind of musical shorthand, and of great convenience to the accompanist. Hence every contrivance which could facilitate sight-reading and simplify matters for the figured bass player was adopted. Before long therefore the figures 10, 11, 12, 13, representing compound intervals, were discarded in favour of the more easily apprehended simple form of these intervals, represented by the figures 3, 4, 5, and 6. This substitution of the simple for the compound form of the interval—except in the case of the Ninth, and the recognition of their identity, as regards their harmonic significance, was a distinct gain not only from a practical but from a theoretical point of view. That the Ninth was an exception, and could not be represented by the simple form of the interval, was owing to the nature of its employment as the retarding note in the suspension 9-8, already made long familiar by the practice of composers.

Most noteworthy was the peculiar position assigned to the *Triad*, especially the consonant triad, which alone of all the harmonies employed required no figuring. The reason for this cannot have been wholly in order to facilitate practice. From the outset the consonant triad, both in its major and minor form, appears to have been regarded as of peculiar importance, and as possessing qualities shared by no other harmony.

The term *trias harmonica* is, according to Dr. Riemann,¹ used by Joh. Lippius² as early as 1609. Before the middle of the seventeenth century one finds the major and minor common chord referred to as *l'accordo perfetto* among musicians in Italy. Later the same term, *l'accord parfait*, apparently borrowed from the Italians, appeared in France; although as early as 1636 Mersenne, in his *Harmonie Universelle*, speaks of the *harmonie parfaite* which, he informs us, is an expression in general use. The English name *common chord* is found in Gottfried Keller's *Rules for Playing a Thorough-Bass* (1707), although it is likely to have been in use before this date. In Germany the consonant triad was designated in various ways. Joh. D. Heinichen³ makes use of the terms *Hauptaccord*, *Ordinaraccord* (common chord), and *Trias Harmonica*, and remarks:—"The chief and most excellent combination of consonances from which a musical harmony can arise is that known to all musicians as the *trias harmonica*, which consists of a bass note, Third and Fifth." The sounds composing this chord could be arranged in any order above the bass without altering the essential nature of the harmony. The three different orders of distribution are thus given by Heinichen: (a). But many other arrangements were possible, as at (b):—



In the same way any number of voices or instruments might take part, without radically changing the nature of the chord: (c).⁴

¹ *Geschichte der Musiktheorie im IX.-XIX. Jahrhundert.*

² In his three *Musical Disputations*.

³ *Neu erfundene und gründliche Anweisung*, etc., 1711.

⁴ Heinrich Albert, in the Preface to the second part of his *Arien* (1643) says:—"It is known that all musical harmony, even although a hundred voices take part in it, consists of three sounds only." Mattheson makes the same remark in his *Neueröffnete Orchester* (1713).

All this represented a marked advance towards a truer appreciation of the nature of harmony. Further, it was observed, as it could scarcely fail to be, that a close relationship existed between a chord and its inversions, seeing that all were composed of practically the same sounds. Add to this that Zarlino had already treated of the inversion of intervals. It was known for example that the Sixth represented the inversion of the Third, the Fourth of the Fifth, the Fifth of the Fourth, and so on. Are we therefore entitled to assume that composers and writers on music of this period were acquainted with the nature of Harmonic Inversion? Dr. Riemann¹ cites a passage from the *Hodegus Curiosus* (1687) of Andreas Werckmeister which, he is of opinion, not only treats specifically of fundamental chords and their inversions, but already embodies the complete theory of the inversion of chords. The passage is as follows:—“Harmony consists of the union not of like, but of unlike or diverse elements. As all consonances are of good effect, and please us because of their clearness, we try to arrange them in every possible order. Therefore we may take the Third, the natural position of which is above the ground-tone (this ground-tone, occupying the lowest position, being reckoned as the *root*) and use it instead of the ground-tone, which then appears as a Sixth above it; for if the Fifth or Third is not present in any combination (*Satz*), then the regular series of ordinal numbers has been departed from, and we have, as it were, a borrowed fundamental note” (“*erborgtes Fundament clavis*”). Dr. Riemann would almost appear to be justified in pointing to this passage as a proof that the theory of the inversion of chords was in reality no discovery of Rameau, but gradually revealed itself to the consciousness of composers and of cembalists in their practice of figured bass accompaniment. But if this is so, why then was this theory not made use of? Writers on figured bass were becoming more and more embarrassed by the new and strange chords which were every day being added by composers to the large number already existing, and were diligently searching for the key towards that inner relationship which, they felt, ought to exist between the numerous and otherwise isolated harmonic combinations.

¹ *Geschichte der Musiktheorie.* (Footnote, p. 431.)

Here, in the theory of Harmonic Inversion, was the only possible key towards a rational system of chord classification. Why was it not immediately taken advantage of, and why was it necessary to wait for the appearance of the *Traité de l'Harmonie* of Rameau?

In the meantime it may be observed that Werckmeister presents us with nothing that was really new. His remarks on the consonances, on the nature of harmony and of its origin, are only an echo of what had already been said by Zarlino¹ in treating of intervals and no more than Zarlino does he speak of "fundamental chords" and their inversions, but only of intervals. It is just the importance which not only Werckmeister but his contemporaries attached to the interval—for each interval had its own peculiar harmonic significance—which gave rise to so much confusion and uncertainty as to which chords should be regarded as original, and which as inverted. For Werckmeister the fundamental note of the chord *e-g-c'* is not *c* but *e*. Like Zarlino, Werckmeister explains the consonances as arising successively from the numerical series 1 : 2 : 3 : 4 : 5 : 6—(8). But while the Fourth (3 : 4) arises directly from this series, the Sixths (3 : 5 and 5 : 8) arise accidentally.² It is necessary to include the number 8, even if it introduces a gap in the series of numbers, for otherwise the Minor Sixth cannot be found.³ This is not Rameau's view. Rameau expressly declares that neither the Fourth nor minor Sixth should be regarded as an "original" but as a "derived" interval. What Werckmeister is chiefly concerned to point out is, not that the major harmony produces

¹ Compare, e.g., the passage from Zarlino's *Istituzioni harmoniche*, Pt. III., Cap. 29, which begins:—"Consciosia che molto ben sapeuano, che l'Harmonia non può nascere se non da cose tra loro diuerse, discordanti et contrarie et non da quelle ch'in ogni cosa conuengono." Also Pt. I., Cap. 15. (Delle proprietà del numero senario & delle sue parti & come tra loro si ritroua la forma d'ogni consonanze musicale).

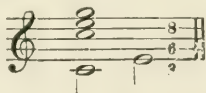
² "Wenn wir die **Musicalischen Proportional Zahlen** betrachten, so . . . sehen wir erstlich daraus den rechten Sitz aller *Consonantien*, da wir denn befinden dass die *Octava* erst, darnach die *Quinta*, dann die *Quarta* und *Tertia Major* und *minor* folge, die *Sexten* aber stecken zufälligerweise in diesen Zahlen 1 : 2 : 3 : 4 : 5 : 6—8." (*Musicalisches Memorial*, 1697, Ch. 1.)

³ "Wenn diese Zahl 8 nicht dabey wäre, so konten wir keine *Sextam minorem* in dieser Ordnung haben, als 5 : 8." (*Musicalische Paradoxal-Discourse*, 1707. Ch. 19.)

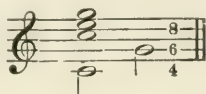
all the consonances, but that the consonances, arranged in a certain order, give rise to the major harmony, which is exactly the view taken by Zarlino. Further, too much importance need not be attached to Werckmeister's use of the term "root." He describes the series 1:2:3:4:5:6 as a series of "roots" ("*Radices*"); and further tells us that by means of the addition of the first four terms of this series there results the number 10, which is the "root" of the minor harmony 10:12:15.

Keller would appear to be familiar with the theory of the inversion of chords, when he says¹:—"To make some chords easie to your memory you may observe as follows:

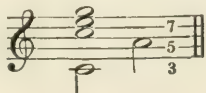
(a) A common chord to any note makes a $\begin{smallmatrix} 8 \\ 6 \\ 3 \end{smallmatrix}$ to the Third above it or Sixth below it, as—



A common chord makes a $\begin{smallmatrix} 8 \\ 6 \\ 4 \end{smallmatrix}$ to the Fifth above it or Fourth below it," as—



Here Keller might describe the notes *e* and *g*, in the lowest part, as "borrowed fundamental notes." But that he is merely elucidating the method of figuring, and not explaining the process and nature of inversion, is clear from what immediately follows: "(b) A common chord makes a $\begin{smallmatrix} 7 \\ 5 \\ 3 \end{smallmatrix}$ to the Sixth above it, or the Third below it," as—



In this case it is quite impossible to consider the note *a* as bringing about an inversion of the original chord, *c-e-g*.

Heinichen employs the same term as Werckmeister (*fundamental clavis*) to designate the lowest note in all chords,

¹ *Rules for Playing a Thorough Bass.*

whether inverted chords or not. He recognizes quite clearly that chords may consist of different intervals, and yet be composed of practically the same sounds. Nevertheless, how completely he fails to grasp the difference between fundamental and inverted chords is evident from the following passage: "The chord (*Hauptaccord*) $d-e-g\sharp-b$ is capable of the following three changes of its harmony: (1) $e-d-g\sharp-b$; (2) $g\sharp-e-d-b$; and (3) $b-d-e-g\sharp$."¹ Here the chord described as original, as a *Hauptaccord*, from which the others would appear to be derived, is itself a derived chord, namely, the last inversion of the chord of the Dominant Seventh, $e-g\sharp-b-d$. Even more striking is the example which he thus explains:

"If now we invert the chord $\overset{9}{\underset{3}{8}}$, so that the Sixth appears in the bass, we obtain a syncopation of the Fourth, thus "² :—

(a) Accord. (b) Verkehrung.

9 8 6 3 4 3

In this case Heinichen not only "inverts" an inverted chord, but describes the fundamental position of the chord at (b) as an inversion, which is of course exactly the reverse of the real state of matters.

Like almost every author who has before or since written on the subject of the theory or practice of harmony, Heinichen in the first part of his book *Der General-bass in der Composition* (1728) devotes a chapter to the consideration of the different intervals (Ch. 1). In addition to the table of diatonic intervals, consonant and dissonant, which played such an important part in the works of the older theorists, we find several new ones, both diatonic and chromatic. Chief among these are the diminished Fifth (as $b-f$) and the augmented Fourth (as $f-b$): the first being found in the first inversion

¹ *Der General-bass in der Composition*, Part II., Ch. 1.

² *Ibid.*, Part I., Ch. 3.

of the chord of the Dominant Seventh ; the second in the third inversion of the same chord. Thus the dreaded *Mi contra Fa*, the great stumbling-block of an older generation of composers, had become by its incorporation in the chord of the Dominant Seventh the chief ornament of the new music. There are also the augmented intervals of the Second, Fourth, Fifth, and Sixth ; and the diminished intervals of the Fourth, Fifth, and Seventh. The only compound intervals mentioned are the major and minor Ninths.

The second chapter treats of the consonant triads of the Major Mode (*triades harmonicae*). The third chapter deals with the inversions of these triads,¹ and with all other harmonic combinations used in figured bass practice. Beginning with the chords of the Sixth, Heinichen proceeds to treat of the various dissonant chords, among which he includes the chord of $\frac{6}{4}$, the second inversion of the consonant triad. Two systems of chord classification are adopted. In the first, a distinction is made between chords which are consonant and those which are dissonant. In the second, the dissonant chords are classified according to the species of the interval which forms a dissonance with the bass, and according to the order in which the intervals are arranged in Ch. I. "The [interval of the] second is the first dissonance" : therefore the first dissonant chords to be considered are those which contain the interval of a second between the bass and an upper part. They arise for the most part from a suspended or "syncopated" bass, which is duly prepared and resolved thus :—

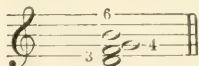
(a) (b) (c) (d)

6 6 6 6 5 6 5 6
4 4 4 4 4 4 2 2
2 2 2 2 2 2 2 2

In examples (a) and (b) the second chord is the third inversion of the chord of the Seventh on the Supertonic and Dominant

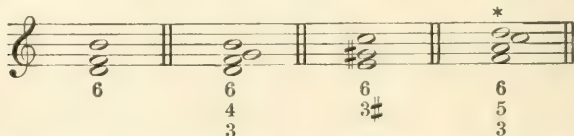
¹ Including the first inversion of the diminished triad on the leading note.

respectively. At (c) the second chord is the chord of the Dominant Seventh, the third of the chord being retarded in the bass. At (d) we have merely, in the second bar, the first inversion of the Tonic triad, the Third of which is retarded in the bass. But notwithstanding the widely divergent harmonic conditions which obtain in these examples, Heinichen, so far as the theoretical aspect of the question is concerned, treats them all alike: they are all dissonant chords of the Second, arising from a "syncopated" bass. Such a system of chord classification is, of course, quite inadequate and misleading. Nor is Heinichen able even to draw an effective distinction between the two main classes of consonant and dissonant chords. For among the former he includes several which are dissonant, such as the first inversion of the Diminished triad, and the second inversion of the chord of the Dominant Seventh. In the latter chord, which is introduced among the consonant chords of the Sixth, we have the dissonance of a Second occurring between the notes *f* and *g*:—



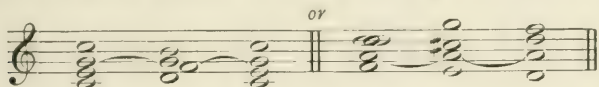
But as the intervals which compose the chord are reckoned from the bass note upwards, that of the Second cannot be included, for according to this theory of chord formation the only intervals present are those of the Third, Fourth, and Sixth.¹

¹ Johann Mattheson, in his *Kleine Generalbass Schule*, 1735, thus defines the term *chord*:—"A chord is the union of several sounds, from two up to eight or more, which are either pleasing, or harsh and discordant, according to their relation with the ground tone [bass note]." As therefore, in the figured bass schools of this time, all chords are considered to arise from a combination of various intervals, and are, theoretically at least, regarded as consonant or dissonant according to the nature of the intervals which occur above the bass, chords such as the following are a source of considerable perplexity:—



for the intervals of which they are composed, reckoned from the bass upwards, are all consonant. As for the chord at *, while Mattheson regards it as consonant, Heinichen recognizes its dissonant nature,

Heinichen explains the chord thus: "To the minor Third and major Sixth [as in the chord of the Sixth *d-f-b*] may be added the perfect Fourth. This Fourth appears in the previous chord, and *may be allowed to remain* in the \sharp chord": thus:—



This Fourth, the real fundamental note of the chord, is described as merely an accessory note (*Hülfs-stimme*). It should be noted that although Heinichen regards the Diminished triad as a dissonant chord,² he considers its first inversion to be consonant.

Of the numerous dissonant chords treated of, we find various chords of the Seventh and their inversions, principally those on the second, fifth, sixth, and seventh degrees of the major scale; and on the second, fourth, fifth, and sixth degrees of the minor. The chord of the Diminished Seventh, with its inversions, occurs in the Minor Mode; also the Augmented triad on the third degree of this mode, in its first inversion. Of chromatic chords there are the three forms of the chord of the Augmented Sixth. Examples are also given of the pedal point, and of the suspensions of the major and minor Ninth, which may be accompanied by simultaneous suspensions in one or more of the other parts: as $\frac{9}{7} \frac{8}{6}$, $\frac{9}{4} \frac{8}{3}$, or $\frac{9}{7} \frac{8}{6} \frac{8}{4} \frac{8}{3}$. Heinichen does not treat specifically of the triads proper to each degree of the

and—a noteworthy circumstance—even determines that *c* is the dissonant note, in which case he can have been guided solely by his ear. For he is quite unable to explain why this note *c*, which makes with the bass a perfect Fifth, one of the smoothest of consonances, should be regarded as dissonant. He is of opinion however that the perfect Fifth, although in itself consonant, may still be employed "after the manner of a dissonance" (Ch. 3, § 34).

² Heinichen understands quite well the exceptional nature of the Diminished triad on the leading note, and refuses to give it a place among the other triads of the major scale. His employment of this triad is noteworthy. It never appears except with the addition of the minor Sixth, as (*b-d-f-g*); therefore as Third, Fifth, and Seventh of the chord of the Dominant Seventh. Even when the chord is taken in its first inversion Heinichen prefers, as is evident from what has been said above, to add to it the perfect Fourth, again obtaining Dominant Seventh harmony.

minor scale, but except in the case of the Augmented triad on the third degree and the Diminished triad, which may form part of the chord of the Diminished as well as of the Dominant Seventh, seems to imply that they are to be used in a way similar to those of the Major Mode. In the second part of his work he devotes a lengthy chapter to the treatment of dissonances (beginning with the Second, and proceeding up to the Ninth) and their resolutions, peculiar to the free or dramatic style of composition. Here, as well as in the other sections of the work, which are taken up chiefly with the consideration of the various circumstances relating to the melodic figuration of the parts above the figured bass, as well as of the bass itself, Heinichen shows much sagacity and musical insight. Such then was the harmonic material in most common use among composers when Rameau published his *Traité de l'Harmonie*. "These are," says Heinichen, "the most usual signatures of general-bass." But dissonant chords, he proceeds, "are so to speak innumerable, and may by good practicians be daily varied and invented."

Joh. Mattheson (1681-1764), in his *Kleine General-bass Schule*, strives even more assiduously than Heinichen to arrive at a rational system of chord classification. He adopts not one but several methods. First of all he distinguishes, like Heinichen, between consonant and dissonant chords. Then he classifies all the chords, both consonant and dissonant, according to the interval which distinguishes each, beginning with chords of the Second, of the Third, of the Fourth, etc., and concluding with those of the Ninth. Subsequently he gives still another arrangement, and divides the chords, which number seventy in all, into three classes or orders. The first class comprises "the most common and most harmonious chords," twenty-four in number; the second class, those which are less common; and the third, those which are least frequently used. The last two classes consist of dissonant chords only. Mattheson is even less successful than Heinichen in correctly distinguishing between consonant and dissonant chords. Among the former he includes the first inversion of the chord of the Dominant Seventh ($\flat^{\frac{6}{5}}$) and of the Diminished Seventh ($\flat^{\frac{6}{5}}$); and the first inversion of the chord of the Seventh on the Supertonic of the major scale ($\frac{6}{5}$). With respect to the Diminished triad

on the seventh degree, he at first rejects it, altering it chromatically so that it appears as a minor triad ($b-d-f^\sharp$); afterwards however placing it on an equal footing with the other triads of the major scale, *i.e.* as a consonant triad. Mattheson's description of some of the chords just mentioned is peculiar. Thus the chord $e-g-bb-c^\sharp$, which we understand as the first inversion of a chord of the Diminished Seventh, he terms an *augmented* chord; the augmented interval being $e-c^\sharp$! So also with the "*consonant*" chord $e-g^\sharp-c$ ($^{\text{7th}}$), which is described as a chord of the Diminished Sixth—the diminished interval being $e-c$ —whereas the real diminished interval is that of the Fourth, *viz.*, $g^\sharp-c$. It can only have been on theoretical grounds that Mattheson described such chords as consonant, for he was too good a musician not to perceive their dissonant effect.

The common chord, major or minor, is termed a *perfect* harmonic triad. It is the presence of the Tonic and Dominant, the principal notes of the scale, in the common chord on the Tonic which gives this chord its perfection, the Third being added *as a matter of course* in order to complete the harmony. The other triads of the scale, which are likewise composed of the intervals of the Third and Fifth, are then perfect by their analogy with the Tonic triad. Hence Mattheson's vacillation in respect of the Diminished triad on the seventh degree.

After an examination of the twenty-four chords contained in his first table, he proceeds: "So far we have been dealing with the *most common consonances*, [1] now we have to treat of dissonances, or the less usual chords: and first of all, the Second." These chords of the Second are produced by a suspended bass-note, and are of four different kinds: (1) Chords of the diminished Second; (2) chords of the minor Second; (3) chords of the major Second; (4) chords of the augmented Second; and are to be distinguished thus according to the variety of the interval of the Second occurring between the bass note and an upper part. The diminished Second, according to Mattheson, is the Semitone, which may be either diatonic or chromatic; the minor Second corresponds to the ratio 9 : 10; the major Second to 8 : 9. A distinction is made between the $\frac{6}{2}$ chord (last inversion of chord of the

Dominant Seventh) in which the bass note is prepared, and that in which it is not prepared, as :—

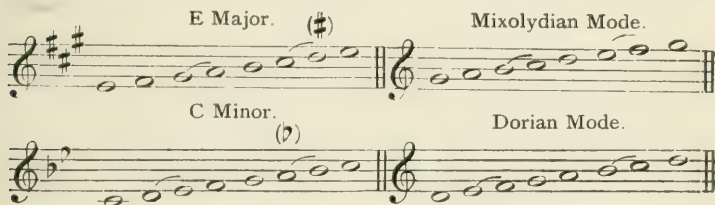
(a) (b)

5 4 2 6 6 6 6 6

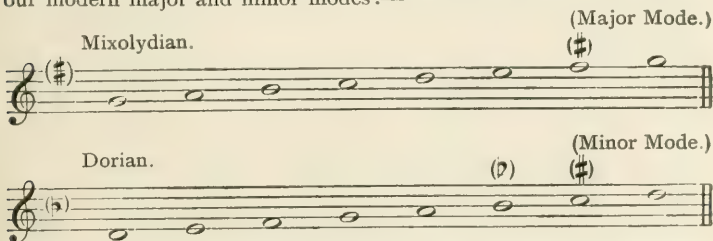
In the first case, “ the Fourth is merely an accessory note beside the Second ”: in the second case, “ the Fourth becomes the chief note : the Second is the accessory note ” (*Nebenklang*) ! The Fourth, which may be diminished, “ major ” (perfect) or augmented, “ has 14 different resolutions. There is not space to deal with them all here . . . the theory of these resolutions is treated of in Heinichen’s *Der General-bass in der Composition*. ” So also “ the Ninth may be resolved in eight different ways. ” Mattheson examines minutely the various circumstances relating to the appropriate treatment of each of his seventy chords ; whence arise an extraordinary number and diversity of rules, exceptions from rule, and the like ; and as if the rules were not already numerous enough, barren distinctions are drawn between chords identical in their nature and manner of employment. On the other hand he is quite aware of the great change which the art of music had undergone, in that it was no longer based on the twelve Church modes, but made use of two only, namely, our major and minor modes. Heinichen insists on the same fact, and even urges a reform of the illogical method, then in use, of indicating the key-signature. Thus in the major mode the sharp necessary for the leading note was not included in the key-signature ; nor in the minor mode the flat which indicated the minor Sixth ; so that, for example, E major had for key-signature three sharps instead of four, and C minor had only two flats instead of three : the degrees of the scales in question being chromatically altered

by means of the necessary accidentals.¹ Heinichen says : "It cannot be denied that, for example, in the E major mode the major Seventh $d\sharp$ is as natural and essential as is the $b\flat$ in the C major mode ; nevertheless in practice this sharp is seldom included in the key signature, but for the most part is indicated by an accidental placed before the note, which itself appears to have an accidental character. The minor Sixth [in the minor mode] is indicated in a similar

1 The effect of this practice, which prevailed well into the eighteenth century, *i.e.*, up to the time of Bach and Handel, was to give to the major scale in sharp keys the same form, the same order of tones and semitones, as the seventh Church mode, the *Mixolydian* ; and to the minor mode, in flat keys, the same form as the first Church mode—the *Dorian* ; thus :—



The exclusion from the key-signature of the flat necessary for the sixth degree of a minor scale was in conformity with the traditional practice in respect of the Dorian mode, where a Minor Sixth— $B\flat$ —was required in order to avoid the tritone, $f-b$; but which was not written. If, therefore, we add to the Dorian mode the flat necessary in order to indicate the minor Sixth, and to both Dorian and Mixolydian modes the sharp necessary for the seventh degree, in order to obtain the semitone below the Final required for the Final Cadence, we obtain our modern major and minor modes :—



All this throws an interesting light on the manner of development of our major and minor modes from the old modes of the Church. It should be noted that, even in our own day, the sharp necessary for the seventh degree of the minor scale is never included in the key signature, but invariably prefixed as an accidental.

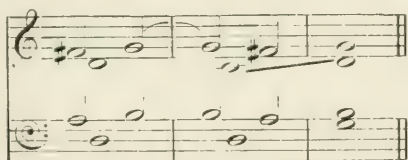
way" ¹ (by a flat prefixed to the note in question). But although Heinichen pleads for a rational method of indicating the key-signature, he himself, none the less, names the various degrees of the *f*♯ major scale as follows: *f*♯, *g*♯, *b*♭, *b*♭, *c*♯, *d*♯, *f*, *f*♯; and those of *b*♭ minor thus: *b*♭, *c*, *c*♯, *d*♯, *f*, *f*♯, *g*♯, *b*♭. Characteristic of the time, also, is Mattheson's description of the minor triad on *d*♯, for example, as *d*♯-*f*♯-*b*♭; while the chord of the Dominant Seventh on *e*♭, is *e*♭-*g*-*b*♭-*c*♯; but the chord of the Augmented Sixth on *g*,—*g*-*b*-*F*.

Of other works of the time treating of figured bass, there may be mentioned the *Principles of Accompaniment at the Clavecin*, 1727, by J. F. Dandrieu, a Parisian organist and composer. Mattheson especially commends its system of chord classification, a system which he himself adopted. A work which appears to have been held greatly in esteem, and which according to Spitta was familiar to J. S. Bach, was the *Musikalische Handleitung* of Friedrich Erhardt Niedt, the first part of which was published in 1700. This treats of chords and their signatures: of cadences, and simple formulas of modulation. A second part (1706) describes the different methods of varying the bass part; instead of moving stiffly from one to another harmony note, this may by means of scale and arpeggio figures, of passing and auxiliary notes, be made more melodically interesting. In the same way, the upper parts are susceptible of a great many forms of variation. The third part (1717) treats of Counterpoint, Canon, and various forms of vocal composition. A second edition of the second part of the work was given by Mattheson in 1721, in an enlarged form. The great merit of Niedt, according to Fétis, is that "he for the first time presents the chords of the Dominant Seventh and Dominant Ninth in their true character, *i.e.*, as capable of being taken without preparation." ² Fétis however cannot understand why Niedt, having made such a notable advance in the science of harmony, should frequently resolve the Seventh in the chord of the Dominant Seventh *upwards*, instead of allowing it to descend one degree, which is its natural resolution. He says:—"The ninth chapter, which treats of these chords, presents us with several examples

¹ *Der Generalbass in der Composition*, p. 150.

² *Esquisse de l'histoire de l'harmonie*.

of a false ascending resolution of the Seventh. This fault is frequently repeated. It is remarkable that Mattheson, to whom we owe a second edition of the second part of Niedt's book, should have said nothing of this irregularity." This "irregularity" is indeed for Fétis not only a remarkable but an awkward fact. But it is not astonishing that Mattheson should have said nothing concerning Niedt's false resolution of the Seventh, seeing that he frequently does the same thing himself; as for example in the following succession of chords from that section of the *Kleine Generalbass Schule* which treats of chords of the Seventh:—



Although Niedt's work is regarded by Fétis as having given "a wholesome impetus to the theory of harmony," it nevertheless brings forward no new theoretical principles; the aim of its author is rather to present, in as clear and concise a form as possible, the rules relating to the science of figured bass.¹

The same traditional views respecting the nature of harmony, and the attempt to apply to chords and their treatment the old contrapuntal rules originally designed to apply only to intervals, characterize also the other works of this time which treat of Figured Bass and Accompaniment; such as those of G. M. Bononcini (*Il pratico musico*, 1673); J. A. Delaire (*Traité de l'accompagnement*, 1690); J. Boyvin (*Traité abrégé de l'accompagnement*, 1700); and Fr. Gasparini (*L'armonico pratico al cimbalo*, 1683). But an important consequence, especially in its influence on the theory of Rameau, of the practice of accompaniment not only from a figured but also from an unfigured bass was the gradual development of what became known as the "rule of the octave" (*Regula dell'ottava*; *Règle de l'octave*), a simple, concise harmonic formula which prescribed for each note

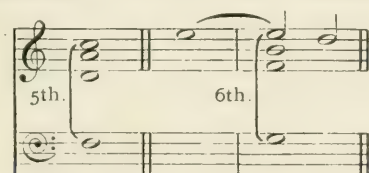
¹ This is to some extent indicated by the title: *Musikalische Handleitung, oder Gründlicher Unterricht, vermittelt welchem ein Liebhaber edlen Musik in kurzer Zeit sich so weit perfectioniren kan*, etc.

of the scale or key system its appropriate harmony. The chords employed for this purpose consisted of, or were derived from, the three principal harmonies of the key namely, Tonic, Dominant, and Subdominant.¹ This formula was made the basis of a system of instruction in composition by Fr. Campion, in his *Traité de Composition selon la règle de l'octave* (1716). But such works as those of Gasparini, Delaire, Heinichen, and Mattheson, all of which treat of the "rule of the octave," were evidently regarded as schools of composition, as well as of accompaniment from a figured or unfigured bass.

From the foregoing a sufficiently adequate idea may be obtained of the state of matters which prevailed when Rameau set out to discover the fundamental principles of harmony. It was clearly perceived that the Church Modes had given place to our Major and Minor Modes. It was recognized that between the simple and compound forms of the interval no theoretical distinction, as regards their harmonic significance, need be maintained. The consonant triad is given a place by itself, and assigned a special name (*common chord*, *trias harmonica*, *l'accordo perfetto*); that on the Tonic being regarded as of peculiar importance. The relationship existing between a chord and its inversions, in so far as all are perceived to be composed of the same sounds, is understood; while the lowest note of every chord, whether inverted or not, is described as the fundamental note of the chord. But most noteworthy of all and dominating, if not the practice of harmony, at least every conception as to the nature and properties of chords is the theory, not only implied but expressed, that chords are the result of the (arbitrary?) union of intervals, and are consonant or dissonant, pleasing or the reverse, according to the nature of the intervals which occur between the bass and the upper parts. This was the outlook on harmony which undoubtedly prevailed up to the time of Rameau. Is it unworthy of being described as a theory, or regarded as a principle of chord generation? On the contrary, it is not only a very old theory but a very respectable one, and plays a most important part in the theory of the generation of chords as this is understood by many even at the present

¹ See also pp. 118-120.

day.¹ It dates from the first beginnings of polyphonic music. But however adequate it may have been then, or in the time of Dufay, of Deprés, or even of Palestrina and Lassus, when the harmonies in use were few, simple, and for the most part consonant, it was quite inadequate for the new harmonic conditions which had arisen during the course of the seventeenth and the beginning of the eighteenth centuries. The conception of harmony as arising from the arbitrary addition of sounds above any bass note, besides having become insufficient for the explanation of the facts, had led to the most contradictory results, even to the extent of admitting, as consonant, chords that were dissonant, and turning into dissonances intervals that were consonant. Thus in the following chords:—



c, the Fifth above the bass note, was considered to be the dissonant note in the first chord,² and e, the Sixth, the most characteristic dissonance in the Second. But both Fifth and Sixth are consonant intervals. It was therefore concluded that these intervals, although in themselves consonant, might nevertheless be employed "after the manner of dissonances." But other intervals were a source of equal embarrassment. Especially was this the case with the Fourth. The Fourth, theoretically recognized, and rightly so, as a perfect consonance—or at least the most perfect consonance after the Fifth—was perceived in practice to produce a dissonant effect,³ as it had been by generations

¹ Thus the triad is said to result from the union of two Thirds, or of a Third and a Fifth; a Third added above this triad gives the chord of the Seventh; a Third added above this chord of the Seventh gives the chord of the Ninth, and so on.

² So with Heinichen and Keller; Mattheson, however, considers this chord to be consonant.

³ Thus Gasparini says: "E veramente la Quarta posta fra le Consonanze, sì da gli Antichi, come da' Moderni vien considerata per Consonanza perfetta, ma fu disapprovata di usarla per fondamento. Onde per tal ragione, e per il nostro proposito la chiameremo Dissonanza." (*L'armonico pratico al cimbalo*, Ch. 7.)

of composers before this time, and has been up to the present day. It was therefore placed among the dissonant intervals. Being dissonant, it required to be resolved, and to be followed by the Third. Hence we have this remarkable result of the interval theory of chord formation; the Fourth, one of the smoothest of consonances, produces even when used alone, and not in combination with other intervals, a dissonant effect; further, its most natural resolution is on the Third, an interval which is not nearly so consonant as itself!

It was this view of the nature and constitution of chords which, in part at least, prevented writers on music and theorists of this period from anticipating Rameau's theory of harmonic inversion. Acquainted as they were with the intimate relationship existing between Octave sounds, as well as with the fact that in the case of a chord and its inversions each chord consisted of practically the same sounds, it must appear strange, until all the circumstances are taken into account, that they did not make a practical use of the knowledge they possessed for the purpose of simplifying their signature tables, of reducing the number of their rules, and making their application less difficult and obscure. Rameau refers to this matter as follows: "The knowledge of inverted chords," he remarks, "has been gradually acquired; but as this knowledge has been gained by experience alone, the principle has been lost sight of; whence has arisen an infinity of exceptions, equivocations, subterfuges. *Inverted chords have been regarded as original*, while terms, intervals, chords, their progressions and properties, have all been jumbled together."¹

So then, although it was quite clearly perceived that in a chord and its inversions each chord was composed of the same sounds, this did not shed much light on the question. For was not each chord composed of different intervals; and could it be maintained that there was anything in common between a Third and a Fourth, or between a Fifth and a Sixth? Each chord, then, must be considered to have its own fundamental note, for was it not from this fundamental note that the intervals placed above it were determined?

This question of a fundamental note is intimately connected with the whole subject of harmonic inversion. In the

¹ *Traité de l'harmonie*, Bk. II., Ch. 18, Art. I.

figured bass schools of the latter part of the seventeenth century the conception of a fundamental note appears to have been so natural, and its necessity so obvious, that although the term (*Fondamento*; *Fundament-clavis*) was new it was either not defined at all, or explained merely as the lowest note of an interval or chord. But if the term was new, the principle it stood for was not. It is quite wrong to suppose, as is frequently done, that the custom of regarding chords as arising from the addition of intervals above a bass note was the necessary outcome of figured bass practice; that is, of the use of figures, as ♯, ♭, etc., to designate the intervals of which the chord was to be composed. Such a theory of chord formation had long been in use. From the time of Zarlino, and indeed before his time, composers had reckoned their intervals from the bass upwards; thus, in the case of the interval *c-g*, *g* was regarded as Fifth of *c*, and not *c* as Fifth of *g*. This is a fact not without significance for the theory of harmony, for intervals might quite as easily be reckoned *downwards*.

It is not in the figured bass system that we must seek for the origin of such a custom. On the contrary, it was this theory of the bass as fundamental note which lay at the root of the whole figured bass system. The bass was the bearer of the harmony; the sound from which all the other sounds composing the chord were determined. But, as has already been pointed out, this conception of the fundamental note as the lowest or bass note of every chord was quite inadequate for the purpose of determining the consonant or dissonant character of a chord, seeing that not a few dissonant chords were composed of intervals all of which were consonant with the bass. So also it was inadequate for the purposes of a theory of harmonic inversion: more accurately, it made such a theory absolutely impossible. It completely barred the way.

Before Rameau published his *Traité de l'harmonie*, it was considered—and this cannot be too frequently insisted on—that in the case of three chords, such as *c-e-g*, *e-g-c'*, *g-c'-e'*, each chord had a different fundamental note: in the first chord it was *c*; in the second *e*; and in the third *g*. But before the theory of harmonic inversion could be established, it was necessary to prove that all three chords had in reality but one and the same fundamental note. It was necessary

to give to the term *fundamental* a new meaning and definition; above all, to draw a sharp distinction between bass note and fundamental note. How was this to be done? This question may well be asked, notwithstanding the intimate knowledge we of the present day possess of the nature of harmonic inversion. Was nothing more required than to point out the identity, in respect of harmonic significance, of Octave sounds? By such means, it is true, it is easy to demonstrate that the Fourth is the inversion of the Fifth. But it is quite as easy to demonstrate, by the same means, that the Fifth is the inversion of the Fourth. Each interval, then, is "original" and "fundamental"—seeing that each may be regarded in turn as the foundation of the interval which arises from it by inversion—and each has its own fundamental note. This represents exactly the state of matters which prevailed among the theorists and practitioners of the figured bass schools. The mere recognition of the identity of harmonic meaning of octave sounds left matters where they were, in so far as the principle of harmonic inversion was concerned. Rameau's task was to demonstrate not only that *both* the intervals in question had the same fundamental note, but also to show that while the Fourth was derived from the Fifth, it was altogether opposed to a rational conception of the nature of harmony to describe the Fifth as derived from, or as the inversion of, the Fourth.

What is true of intervals in this connection is true of chords. Rameau hits the nail on the head when he states that the fundamental error among theorists of the figured bass schools was that they described "derived chords as original," notwithstanding that they must have perceived the similarity, in respect of harmonic significance, between a chord and its inversions. It was necessary to prove that in the case of a chord and its inversions there existed an original and fundamental chord from which the inverted chords were derived, and that all had but one and the same fundamental note. Rameau had therefore to discover what was the real *Fundamental Bass*, or *Basis*, of these chords. *But nothing of this could be done until there had been brought to light the principle of harmonic generation, or generation of chords.* In no other way could the "fundamental note" be established as the basis, source, and foundation of the harmony.

It is evident then that the principles of Harmonic Inversion, of the Fundamental Bass, and of Harmonic Generation, are all closely linked together, and in fact cannot be dissociated from each other ; and it is no mere accident that Rameau treats first of the principle of Harmonic Generation, and only subsequently of the Fundamental Bass and of the inversion of chords. Rameau's task was not quite so easy as might be imagined. Theorists have too lightly assumed that all that was necessary in order to establish the principle of harmonic inversion, and of the inversion of chords, was to demonstrate the identity of meaning of Octave sounds. But if this had been all, then the credit for the discovery of the principle of harmonic inversion belongs not to Rameau, but to Zarlino. Such indeed is the view taken by Dr. Riemann, who thinks that Zarlino knows all about harmonic inversion.

These remarks relating to the inversion of chords represent facts which, especially with regard to their theoretical significance, have never been properly elucidated. Nothing is more common than to find musical theorists who, although they accept Rameau's theory of inverted chords, nevertheless reject his principles of Harmonic Generation and of the Fundamental Bass ; a fact which, if it does not argue on the part of such theorists an insufficient acquaintance with Rameau's theory of harmony, proves at least that they have inadequately grasped the nature of the intimate connection existing between the principle of harmonic inversion and those principles from which it naturally proceeds.

It was, then, the inability to draw an effective distinction between fundamental and bass note which was mainly responsible for the confusion, obscurity, and uncertainty which prevailed concerning the rules and their application ; a confusion quite well recognised by Mattheson, who says : " These things "—that is, chords, and the rules for their treatment—" bring to the mind more darkness than light, presenting themselves to us as they do in a complicated and disorderly fashion, and leading the thoughts often quite away from what is really essential, which is directly opposed to a good system of instruction." It was in order to discover a means for the more systematic treatment of chords that Mattheson made his various attempts at chord classification,

all of which of course were quite futile. One of his methods of classification is as follows: the table of chords is peculiarly interesting, showing as it does the chords in use at the beginning of the eighteenth century, and also to some extent the nature of the difficulties which confronted Rameau:—

	2nds.			3rds.			4ths.					5ths.				
<i>Signaturen</i>	b2	2	2	3 b2	b	#	4 2	4 3	b4 3	# 6	# 2	# 3	4 5	43	b5	b5
<i>Full- Stimmen</i>	6 4	6 4	6 4	5 3	5 3	5 8	6 6	6 6	6 3	6 6	6 6	8 8	5 8	43	3 8	6 3 8

5ths.			6ths.														
b5 B	5b	5B	6	6	6	6 4	B	B 4	B	6 4 2	6 5	6 b5	65	6b5	65 43	b6 #	b6 4
3	3 x	3 x	3 8	3 6	3 8 6	8	3 x	3 x	3 8	x	3 8	3	3 x	3	x	x	2

6ths.				7ths.													
6 54	b 5	b b5	6 4	7 2	7	7b	7b	7c	7 4	7 b6	7 4 2	7 4 2	7 5	7 5	b7 b5	7 5 2	7 b5
x	3	3	3	4 5	5 3 8	3 x	3 x	3 8	5 8	3	5	5	3 8	3	3	8	3

7ths.						8ths.		9ths.								
7 4	7 4 2	7 5 4	76 36	57 55	57 65	87	857	9	98	9 6	9 7	9 7 4	98 76 56	596 53	93 85	98 76 56
5 8	8	2	3	3 8	3 x	5 3	5 3	5 3	5 3	3	3	5	3	3x	3x	3

CHAPTER II.

GIOSEFFO ZARLINO (1517-1590), AND THE GENERATION OF HARMONY: NATURE AND INFLUENCE OF HIS WORK AS A THEORIST.

IN his search for the "natural principles" of Harmony Rameau was wise enough not to trust solely to his own reflections, but availed himself of every additional ray of light which might help to dissipate some of the obscurity which beset his path. He appears to have studied diligently everything within his reach which had already been written on the subject of harmony. Of the authors quoted by Rameau in his *Traité*, the following are the most important :—*Gioseffo Zarlino* (*Istituzioni harmoniche*, Venice, 1558, and *Dimostrazioni harmoniche*, 1571); *René Descartes* (*Compendium musicae*, 1618; Rameau made use of a French translation of this treatise, entitled *Abrégé de la musique*); *Charles Masson* (*Nouveau traité des règles pour la composition*, 1694); *Marie Mersenne* (*Harmonie Universelle*, 1636-1637, two volumes of over 1,500 pages; the first part only of this work—*Livre I. De la musique théorique*, is mentioned by Rameau. It contains numerous musical illustrations, and was published under the pseudonym of "Desermes," which likewise is the name given by Rameau when he quotes this author). Further, the important work by *Sébastien de Brossard*, which must have proved of great service to Rameau (*Dictionnaire de musique*, first edition in 1703, frequently referred to as the first musical lexicon),¹ and a text-book by *Sr. Frère* (*Les transpositions de musique de toutes les manières*). Of these authors something must be said before we proceed to the examination of Rameau's *Traité de l'harmonie*. Of especial importance are the

¹ This honour, however, would really appear to belong to the work *Terminorum musicae diffinitorium* of *Johannes Tinctoris* (d. 1511).

theoretical researches of Zarlino and Descartes. It has been found necessary to devote a considerable amount of space to the consideration of the theoretical works of Zarlino. For this no apology need be made. The acquaintance with the theoretical achievements of Zarlino is indispensable for a right understanding of the development of the theory of harmony, even of the nature of harmony, and its employment in harmonic music. It has been necessary to define clearly Zarlino's theoretical position, and to show exactly what he accomplished. We find it frequently stated, and generally credited among musicians, that the theory of harmony begins with Rameau. This is, to say the least, an exaggerated statement. It would be more in accordance with the facts to describe Rameau's works as a link, one without doubt of extreme importance, in the chain of the development of harmonic science. It is difficult to imagine that the works of Rameau constitute an exception to those general laws of development which may be observed to mark the progress of every other art and science. Such a notion in fact is altogether erroneous. In the theoretical researches of Zarlino and Descartes we find beyond all question the roots of the theory of harmony of Rameau; how much Rameau was indebted to both these theorists will soon be evident.

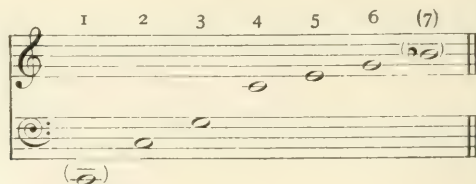
Extremely lucid are the definitions of the two Modes, Major and Minor, given by Brossard and Masson. The former says:—"In every mode there ought to be distinguished three essential notes, namely, the *Final*, the *Dominant*, and the *Mediant*. . . . The Mediant divides the interval between the Dominant and the Final into two Thirds; whence arises what is known as the *Triad* or *Trio harmonique*. . . . As every one of the diatonic or chromatic semitones within the compass of the Octave admits of a major Third being placed above it, there are therefore twelve Major Modes, and as each of these may bear a minor Third, there are also twelve Minor Modes." Masson expresses himself in much the same terms. It is clearly understood that the mode is major or minor according as the common chord on the Final or Tonic is major or minor, and that the essential notes of each mode are the notes of the Tonic chord. Whence it follows that the mode, the scale, has as its basis not *Melody* but *Harmony*. Herein also is the root of the doctrine so vigorously expounded by Rameau that *Melody* arises from *Harmony*.

Even more important however, in respect of its undoubted influence on Rameau, is the definition given by Brossard of the *triade harmonique*, or common chord. This chord, he says, "is composed of three essential sounds, heard simultaneously; none of these sounds being an Octave apart, but two of them lying a Fifth and a Third above the sound which serves as their fundamental. In a word, it is a chord composed of a Third and Fifth, as *Sol-si-re'*, or *La-ut-mi*. . . . The term *harmonique* is without doubt given to it because of the marvellous nature of the perfect Fifth, which naturally divides itself into two Thirds, both of which are excellent and very harmonious: . . . that sound which divides the Fifth so admirably and agreeably into two Thirds is called the *Harmonic Mean*, or *Medius Harmonicus*. The division of the Fifth into two Thirds can be made in two ways: (1) *harmonically*, when the major Third is at the bottom, and the minor Third at the top (as *c-e-g*), then the triad is *perfect* and *natural*; (2) *arithmetically*, when the minor Third is at the bottom, and the major Third at the top (as *a-c-e*), then the triad is *imperfect* and *minor*." The striking resemblance between the language of Brossard and that used by Rameau will soon be evident. Too much importance however need not be attached to Brossard's use of the word "fundamental." With him, as with Heinichen and Mattheson, "fundamental" and "bass" are equivalent terms. On the other hand his conception of the nature of the "harmonic triad" is noteworthy. He regards it as arising, in the first place, from the interval of the Fifth, which naturally divides itself into two Thirds—not the result therefore of the arbitrary addition of Third and Fifth above a bass note—the *Medius Harmonicus* being then the determining factor in respect of the major or minor character of the triad.¹

Rameau's references to Mersenne are chiefly in connection with various acoustical phenomena. Mersenne points to the natural tones produced by certain wind instruments, from the first six of which there arise in succession the intervals of the Octave, perfect Fifth, perfect Fourth, major Third, and minor Third. This natural order of consonances corresponds to the arithmetical series of numbers 1, 2, 3, 4, 5, 6,

¹ Brossard understands the harmonic division of the Fifth as follows:—The Fifth, of which the proportion is $2 : 3 = 4 : 6$, has, as harmonic mean, 5: whereby the Fifth is divided into a major Third $4 : 5$ + a minor Third $5 : 6$.

which represent proportionally the vibrations of the sounding body :—



Mersenne is well aware that the natural harmonic sounds of the trumpet or horn do not stop at the number 6, and can discover no satisfactory reason as to why the consonances should be limited by this number. He cannot understand why, at least, the number 7 should be regarded as introducing a dissonance, and is of opinion that the interval 6 : 7, which is slightly smaller than the minor Third 5 : 6, should be regarded as consonant. Rameau follows Mersenne in his use of the arithmetical series of numbers, but applies this to the division of the monochord.¹ In this of course he acts wrongly, for it is not the arithmetical but the harmonic series, 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, which, applied to the division of the monochord, produces the consonances in the order given above. Mersenne is much occupied with the phenomenon of sympathetic vibration, and is disposed to make the degree of perfection of consonances dependent on the extent of the co-vibration of strings. But between the sounds which constitute the perfect Fourth, as well as the minor Third or the compound forms of these intervals, no power of sympathetic vibration exists. Yet both these intervals are consonant.

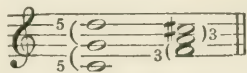
But it is especially Zarlino to whom Rameau constantly refers throughout his theoretical works. Zarlino, he says, is known as the "prince of musicians" (musical theorists), yet is it not Zarlino we have to blame for all the confusion which prevails in musical theory at the present day? Zarlino, with his Church Modes, his endless rules for the progressions of the parts, for the syncopation of notes and the resolution of dissonances, his wrong use of proportions,

¹ In his *Traité*. In his *Génération Harmonique*, however, and subsequent works he makes use of the harmonic series in treating of the major harmony.

his failure to show clearly that melody results from harmony, and not harmony from melody! But Rameau never seemed to have clearly grasped the fact that he lived in a different epoch from that of Zarlino, and that the harmonic art of his time was somewhat different from that which existed in the time of the Church composers. Unquestionably he owes Zarlino a great deal more than he appears willing to confess. Zarlino's achievements as a theorist are highly important, and his strong influence on Rameau may easily be traced.

In the *Istituzioni Harmoniche* and *Dimostrazioni Harmoniche* of Zarlino, numbers, proportions, etc., play a great part. Zarlino discusses the relationship which exists between the science of music and arithmetical, harmonic, and geometric proportions, with allusions to Pythagoras, Euclid, Plato, and Aristotle. He shows reasons why music ought to be considered as subordinate to arithmetic. From arithmetic music borrows numbers, and from geometry mensurable quantity.¹ He applies to the monochord a great variety of different measurements, and compares at considerable length the various intervals thus obtained. In his *Sopplimenti Musicali* (1588) he brings forward a scheme of equal temperament, in which by means of a diagram of the strings of the lute he demonstrates how the Octave may be divided into twelve equal semitones. He however concludes that music is neither purely mathematical nor purely natural in its essence; it is partly both, and may consequently be said to be a medium between the one and the other.²

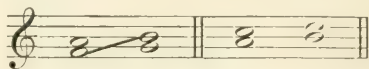
Zarlino considers harmony to be the result of the union not of like, but of unlike or diverse elements. Thus from the union of two intervals of the same species, whether perfect or imperfect, there result inharmonious, that is, dissonant combinations:—



¹ "La Scienza della Musica piglia in prestanza dall' Arithmetica i Numeri e dalla Geometria la quantita misurabile." (*Ist. Harm.*, Pt. I., Cap. 20).

² Compare with Zarlino's definition of music that of Beethoven: "Music is the link which connects the spiritual with the sensuous life." Here it is not the theorist who speaks but the tone-poet.

The Octave however is an exception, because its sounds so completely assimilate. In this necessity for diversity in harmony he also finds the reason for the bad effect of consecutive Octaves and Fifths—like must not be followed by like. Zarlino quite consistently extends this prohibition to the Imperfect as well as to the Perfect intervals. Therefore two major Thirds should not be taken in immediate succession, nor even two minor Thirds :—

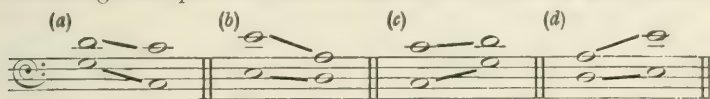


Still, two minor Thirds may on occasion be permitted, as they are "so far removed from the perfection of the perfect consonances." In the progressions by Fifths and major Thirds, also, it will be observed that each voice proceeds by the equal step of a whole-tone; but it is only when one of the parts proceeds by a whole-tone, and the other by a semitone, that a good effect is produced. This half-tone step constitutes "the principal ornament of harmony," and where it is absent every modulation in harmony (that is, progression from one to another interval within a *mode*), sounds harsh and as it were dissonant.¹ Like the other theorists of and before

¹ " . . . del semituono maggiore, nel quale consiste tutto'l buono nella Musica, & senza lui ogni Modulatione & ogni Harmonia è dura, aspra, & quasi inconsonante." (*Ist. Harm.*, Pt. III., Cap. 27.)

In an excellent work by William Holder, D.D., Fellow of the Royal Society, written "for the Sake and Service of all lovers of Musick, and particularly the Gentlemen of Their Majesty's Chapel Royal," and entitled *A Treatise of the Natural Grounds and Principles of Harmony* (1694), we find views similar to those of Zarlino with respect to the immediate succession of imperfect intervals of the same species. The author remarks: "It is a Rule in composing Consort Musick, that it is not lawful to make a Movement of two Unisons, or two Eighths, or two Fifths together: nor of two Fourths unless made good by the addition of Thirds in another part; but we may move as many Thirds or Sixths together as we please. Which last is false, if we keep to the same sort of Thirds and Sixths." (Ch. 4.) He admits, however, like Zarlino, that the effect of two minor Thirds in succession is not displeasing, but explains this in a somewhat different way. He says: "In a Third *minor*, which hath two Degrees or Intervals, consisting of a Tone and Semitone, the Semitone may be placed either in the lower Space, and then generally is united to his Third *major* (which makes the Complement of it to a Fifth) downward, and makes a sharp [*i.e.*, major] Key: or else it may be placed in the upper Space, and then generally takes his Third

his time, Zarlino devotes much attention to the various movements of the parts, to the laws of part-writing. In the following examples of hidden consecutive Octaves and Fifths,



he considers the descending progressions at (a) and (b) to sound better than those ascending, as at (c) and (d). It is characteristic of Zarlino that he endeavours to find for this a scientific explanation; he thinks that the second interval at (a) and (b) is more easily apprehended by reason of the comparatively slower vibrations of the sounds which form it.²

Zarlino's importance as a theorist has been duly emphasized by Dr. Riemann in his *Geschichte der Musiktheorie*.³ Dr. Riemann points to the noteworthy fact that Zarlino has demonstrated the possibility of a two-fold generation of harmony; that the major harmony may be shown to result from the harmonic division of a string (by means of the numbers or proportions 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$), the minor harmony, on the other hand, from its arithmetical division (by means of the proportions 1, 2, 3, 4, 5, 6). Dr. Riemann however has permitted his enthusiasm for Zarlino to carry him too far, and has made several statements which are not warranted by the facts. He attributes to the Italian *maestro* a number of theoretical discoveries with which he cannot properly be credited. In so doing he gives an erroneous idea as to what Zarlino actually accomplished, and causes to be overlooked the real significance of some of his theoretical achievements. Zarlino, he tells us, is acquainted not only with the inversion of intervals, but also with the inversion

major above, to make up the Fifth upward, and constitute a flat [*i.e.* minor] Key. . . . I say, if the Semitone in the Third minor be below, then the Third major lies *below* it, and the Air is sharp. If the Semitone be above, then the Third major lies *above*, and the Air is flat. And thus the two minor Thirds join'd in consequence of Movement, are differenc'd in their Relations, consequent to the place of the Semitone: which Variety takes off all Nauseousness from the Movement, and renders it sweet and pleasant." (Ch. 4.)

² *Ist. Harm.*, Pt. III., Cap. 36.

³ *Zarlino und die Aufdeckung der dualen Natur der Harmonie*, pp. 369-406.

of chords; he understands in its full theoretical significance the nature of harmonic inversion; and he has laid down the principle that besides the major and minor harmonies no other fundamental harmonies exist.¹

Dr. Riemann even gives to Zarlino a place among the theorists of our own day (Hauptmann, Öttingen, Riemann). Zarlino has demonstrated, he says, that the intervals of the Third and the Fifth are the sole constitutive elements of composition²; further, that he distinguishes only one species of Third, namely the major Third, as the constitutive element of the minor as well as of the major harmony, and that he has expressly informed us that in the major harmony the major Third (5:4) occupies the lower position, but in the minor harmony, on the contrary, the higher position; that is only the major, not the minor Third is, in Hauptmann's language, a "directly intelligible" interval." Such

¹ "Die 1571 erschienenen *Dimostrazioni harmoniche* beseitigen aber auch den letzten Zweifel daran, dass Zarlino eine vollkommene klare Vorstellung von der Identität der nur durch Oktavversetzungen (*Umkehrungen*) von einander verschiedenen Accordbildungen hatte, und beweisen zugleich, dass er dieselben bereits in den *Institutioni* ebenso meinte, wie er sie hier widerspruchlos darlegt. . . . S. 87 (Ragion. II., Defin. XVII.) ist bereits die sehr wichtige Behauptung aufgestellt, dass die *kleine Sexte* innerhalb des *Senario* zwar nicht wirklich, aber doch 'in potenza' enthalten sei und darum konsoniere! die kleine Sexte hat bekanntlich die Proportion 8:5, und die 8 liegt ausserhalb des *Senario*: da aber die 8 nur eine 'replica' der 4 und 2 ist, so ist doch die kleine Sexte 'potentiell' im *Senario* inbegriffen.

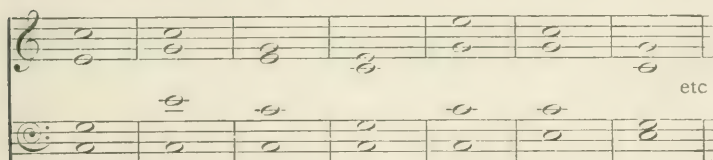
"Damit ist thatsächlich die Identität der Bedeutung aller im Verhältnis der Umkehrung stehenden Harmoniebildungen aufgestellt, und Zarlino's Satz, dass alle Verschiedenheit der Harmonie in der Einstimmung der Terz beruhe, gewinnt den fundamentalen Sinn, dass es ausser dem Dur- und Mollaccord keine Grundharmonien giebt." (*Gesch. der Musiktheorie*, pp. 372-373.)

² "Dass Zarlino mit den *Replicate* wirklich alle Oktavversetzungen, auch die der Terz und Quinte unter den Grundton oder doch die des Grundtones über die Terz und Quinte meint, ist zweifellos: sonst wäre ja auch nicht verständlich, wie so er das gesamte Wesen der Harmonie auf diese beiden Intervalle (Terz und Quinte) könnte zurückführen wollen" (p. 371).

"Dass aber Zarlino auch bereits ebenso wie nach ihm Francisco Salinas, Rameau, Tartini, u.a., und in unserem Jahrhundert Moritz Hauptmann nicht zweierlei Terzen, sondern nur eine und dieselbe Grosse der Terz (5:4) als konstitutives Element sowohl der Dur- als der Mollharmonie annimmt, habe ich bereits anderweit mehrfach betont: Zarlino sagt ausdrücklich, dass im Duraccord (der *Divisione harmonica*) die Terz (5:4) unten, im Mollaccord (der *Divisione arithmetica*) dagegen oben liegt" (p. 373).

then are Dr. Riemann's statements. They have a direct bearing on the subject of this inquiry; and it remains to be seen whether or not, or to what extent, Dr. Riemann is justified in making them.

It has been pointed out that the harmonies in use in the time of Zarlino were few and simple. But it is only to one trained to regard music from our present harmonic standpoint that such harmonic resources appear to be meagre and insufficient. The older art, although it was not on harmony alone that it depended for its aesthetic effect, was nevertheless capable of a very high degree of harmonic expressiveness. Composers of that time did not consider that there was any lack of harmonic material; for them a rich means of harmonic variety existed in the various consonances, and in the various ways of combining them. Not only so, but by different arrangements of these consonances it was possible to obtain a great many different tone-combinations which varied in harmonic effect and expressiveness: a delicate and subtle art which has since been to a great extent lost. For example, the following harmonies represent to us but a single chord, the chord or harmony of *c*. But such was not the view of



the matter taken by the composers of the period in question. For them, these harmonies represented individual tone-combinations, differing in effect, and produced by a varied disposition and combination of the various consonances: of a Third, a Fifth, an Octave, a Tenth, Twelfth, Double Octave, and so on. If then at the time of Zarlino the harmonic material did not comprise a great variety of chords, it consisted on the other hand of a great variety of intervals, simple and compound, and dissonant as well as consonant, for dissonant intervals were made use of as notes of suspension or syncopation, or as passing or auxiliary notes. This large assemblage of intervals constituted for Zarlino a theoretical problem not unlike that which confronted Rameau

at the beginning of the eighteenth century ; only where the former had to do with intervals, the latter had to do with chords. It is worthy of note that Zarlino proceeded much in the same way as Rameau ; that is, he set himself to classify the various tone combinations in use, and to discover their principle of generation.

In the first place, Zarlino makes a sharp distinction between consonant and dissonant intervals. Not the dissonances, but the consonances, are the constitutive harmonic elements of polyphonic composition.¹ A dissonance has no real or separate existence apart from the consonance to which it is related. It not merely retards this consonance, but may even be said to define it more clearly.² Thus Zarlino disposes of the dissonant intervals. This was not a new theory ; it had long been held as an article of faith by theorists and composers.

In dealing with the consonances, Zarlino points to the fact that these correspond to certain simple numerical ratios or proportions. He refers to Pythagoras, who had demonstrated that all the perfect consonances may be expressed by means of the first four numbers. Thus the ratio which determines the Octave is 1 : 2, the Fifth 2 : 3, and the Fourth 3 : 4. For Zarlino therefore the principle which determines the consonances is a mathematical principle—the arithmetical series of numbers. The principle or source of numbers is Unity ; unity is not itself a number, but it is in unity that all things have their origin.³ The varying degrees of perfection of the consonances are determined by the varying degrees of simplicity of the ratios which express them ; the most consonant intervals are those whose ratios are most simple, that is, are nearest to unity. Thus the most perfect consonance is the Octave ; the Fifth is less perfect than the Octave, and the Fourth less perfect than the Fifth. The Octave unites itself so closely with the

¹ "Le Compositioni si debbono comporre primieramente di Consonanze & dopo per accidente di Dissonanze." (*Ist. Harm.*, Pt. III., Cap. 27.)

² "La Dissonanza fa parer la Consonanza, la quale immediatamente la segue più dilettevole." (*Ibid.*)

³ "Ma la Vnità, benché non sia Numero, tuttavia è principio del Numero : & da essa ogni cosa, ò semplice, ò composta, ò corporale, ò spirituale che sia, vien detta Vna." (*Ist. Harm.*, Pt. I., Cap. 12.)

principal sound, represented by unity, that when both are sounded at the same time they give the impression of a single sound; the reason for this being the nearness of relationship of the Octave sound represented by 2 to the principal sound represented by unity.¹ The Octave, then, may be considered as the *replica* of the principal sound. All intervals larger than an Octave are therefore merely *replicas* of those contained within the Octave. Of the intervals which remain there are, in addition to the perfect consonances already mentioned, only the major and minor Thirds and Sixths—the imperfect consonances. The ratio of the major Third is 4:5, while that of the minor is 5:6. All the perfect consonances therefore, as well as the major and minor Thirds, may be expressed by the numbers 1, 2, 3, 4, 5, 6.

These are for Zarlino all the simple or, as he styles them, “elemental” (*clementali*) consonances, which he defines as those consonances whose terms do not differ by anything greater than unity, that may therefore be expressed by any two consecutive terms in the *senario*, or series of six numbers. The major and minor Sixths are not considered by Zarlino to be simple or elemental intervals; neither are they *replicati*, because they do not exceed the compass of an Octave. Zarlino gives them the name of “composite” intervals (*composte*), because they are formed from the union of two simple intervals. The ratio of the major Sixth, 3:5, is capable of a middle term, which is 4; the major Sixth, then, is seen to arise from the union of the perfect Fourth 3:4, with the major Third 4:5.² The minor Sixth (8:5) is also a composite interval, and arises from the union of the perfect Fourth and minor Third, corresponding to the

¹ “Et è in tal maniera semplice la Diapason, che se ben è contenuta da sue Suoni diversa per il sito: dirò così. paiono nondimeno al senso un solo: percioche sono molto simili: & ciò avviene per la vicinità del Binario all’ Vnità” (*Ist. Harm.*, Pt. III., Cap. 3.)

² “L’hexachordo maggiore è Consonanza composta, percioche i minimi termini della sua proportionione, che sono 5 & 3. sono capaci d’un mezano termine che è il 4.” (*Ist. Harm.*, Pt. I., Cap. 16.)

“Vedesì oltre di questo l’hexachordo maggiore, contenuto in tale ordine tra questi termini 5 & 3. il quale dico esser Consonanza composta della Diatessaron & del Ditono: percioche è contenuto tra termini, che sono mediati dal 4.” (*Ist. Harm.*, Pt. I., Cap. 15.)

ratios 8 : 6 : 5.¹ These two composite intervals, although they are not actually (*in atto*) found among the simple consonances comprised within the *senario*, nevertheless exist there potentially (*in potenza*), seeing that they result from the union of simple consonances which actually exist in the *senario*.² The minor Sixth (8 : 5) it is true causes Zarlino some little embarrassment, for 8 lies outside the *senario*; still, he thinks, this 8 may be regarded as the cube of the first number 2, a number which "actually" exists in the *senario*; in any case we know that this minor Sixth results from the union of Fourth and minor Third, both of which are simple intervals.³

Thus Zarlino concludes his classification of the consonances. He distinguishes three kinds of consonant intervals: (1) those larger than an Octave (*Replicali*); (2) simple or "elemental" consonances, and (3) "composite" consonances.⁴

Most remarkable is Zarlino's explanation of the origin of the Sixth. He does not explain the Sixth as arising from the inversion of the Third, but accounts for it in quite a different way. It is not only the minor Sixth (5 : 8) which he considers to exist only "potentially" within the *senario*, but the major Sixth (3 : 5) as well; both have their origin in the union of two of the simple consonances, the Fourth and the major or minor Third. Not only in the *Istituzioni*, but also in the *Dimostrazioni*, he insists that both the Sixths are to be explained in this way.⁵ And yet in the latter

¹ "Alquale aggiungeremo il minor Hexachordo, che nasce dalla congiuntione della Diatessaron col Semiditono. . . . Imperoche ritrouandosi tal proportionione tra 8 & 5, tai termini sono capaci d'un mezano termine harmonico ch'è il 6; il quale la divide in questa maniera 8 : 6 : 5, in due proportioni minori: cioè, in una Sesquiterza & in una Sesquiquinta." (*Ist. Harm.*, Pt. I., Cap. 16.)

² "Però dico . . . che nel Senario, cioè, tra le sue Parti, si ritroua in atto ogni semplice musical consonanza, & anco le Composte in Potenza." (*Ist. Harm.*, Pt. I., Cap. 16.)

³ "Et benche la sua forma non si troui in atto tra le parti del Senario, si troua nondimeno in potenza: conciosiache veramente la piglia dalle parti contenute tra esso; cioè, dalla Diatessaron & dal Semiditono: perche di queste due consonanze si compone: la onde tra'l primo numero Cubo, il quale è 8, viene ad hauerla in atto." (*Ibid.*)

⁴ Zarlino, however, regards the Sixths also as "simple" intervals, in the sense that they do not exceed an Octave.

⁵ "L'hexachordo maggiore, anco il minore, nascono della congiuntione della Diatessaron col Ditono, ò Semiditono: come diligentemente habbiamo dimostrato nel secondo Ragionamento delle Dimostrazioni harmoniche." (*Ist. Harm.*, Pt. I., Cap. 13.)

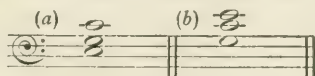
work Zarlino proves that he is quite familiar with the inversion of intervals. He shows that the Fourth is the inversion of the Fifth, the Sixth of the Third, and the Seventh of the Second. He even demonstrates that the inverted interval partakes somewhat of the nature of the interval of which it is the inversion. Thus perfect intervals when inverted give rise to other perfect intervals, imperfect give rise to imperfect, and dissonant to dissonant intervals. For this reason he considers the Fourth to be consonant, for it is the inversion of the Fifth. It must therefore appear strange that Zarlino should have accounted for the Sixths in the way he does: for there seems to have been no reason why he should not have explained the Sixths as arising by inversion from the Thirds. By relating as he does the major Sixth to the major Third, and the minor Sixth to the minor Third, he takes the most effective means of totally obscuring the relationship of inversion which actually exists between the Thirds and the Sixths. For the major Sixth is not related by inversion to the major Third, but to the minor Third; and the minor Sixth is not related to the minor, but to the major Third. It may be thought that Zarlino might have explained at least the major Sixth as a "simple" and not a "composite" interval, and as arising directly from the *scenario*, seeing that its ratio is $3:5$, both of which numbers exist "actually" within the *scenario*. But he could not do this without contradicting his principle of generation of the consonances. This principle is the arithmetical progression $1, 2, 3, 4, 5, 6$, where the consonances find their exact determination in the *successive* terms of the progression. It is not from this progression therefore that the major Sixth can be generated. The major Sixth could arise directly only from a new mathematical and arithmetical progression, namely, $1, 3, 5, 7$, etc. But Zarlino, as might be expected, is by no means prepared to abandon his first progression in order to substitute for it the second. Hence his explanation of the major Sixth as a "composite" interval consisting of the proportions $3:4:5$, which proportions then are represented by successive terms of the *scenario*. The minor Sixth he attempts to account for in a similar way. Its middle term, he tells us, is 6 , and the interval is properly represented by the proportions $5:6:8$, an explanation with which he himself does not appear to be quite satisfied.

Why then does not Zarlino, instead of referring the minor Sixth to the minor Third, with which it has nothing to do, explain the minor Sixth as the inversion of the major Third; why does he not consider the minor Sixth, to use Rameau's language, as a "derived" interval, of which the major Third represents the "original" and "fundamental" form? The answer to this question throws a remarkable light not only on Zarlino's real position with regard to inverted intervals, but on the subject of harmonic inversion in general. Here we find Zarlino in possession of a quite consistent theory of interval inversion by means of the Octave; even maintaining, in despite of all objections to the contrary, that the interval of the Fourth is consonant, because it is the inversion of the Fifth. But Zarlino's theory of the inversion of intervals by means of the Octave, while it enables him to show that the Fifth when inverted becomes a Fourth, and that a Fourth is the inversion of a Fifth, cannot prevent it from being maintained that the Fifth is an inverted Fourth, or that the major Third is an inverted minor Sixth. That is Zarlino, notwithstanding his theory of inversion, is unable to draw any effective distinction between "original" and inverted intervals, for the simple reason that the inverted intervals may themselves be regarded as "original." By no means can Zarlino prove that the minor Sixth is not an "original" interval, but is merely "derived" from an interval which is "original," namely, the major Third. Instead therefore of explaining the minor Sixth as the "inversion" of the major Third, and as derived from it, Zarlino prefers to consider this interval as "original," and to give it quite a different explanation, even if this involves him in the greatest embarrassment and difficulty.

Zarlino however shows no desire, and does not even attempt, to make any such distinction between the various intervals. He considers all the consonances to be "original" and "fundamental." Each consonance has its own peculiar character, and Zarlino regards this as a happy circumstance; for, as he repeatedly insists throughout his works, it is by the use of the consonances, each of which produces its own characteristic effect, that the composer is able to obtain a great variety of the harmony. In short, although Zarlino explains the consonances as arising successively from term to term of the *senario*, he nevertheless looks on each of the

intervals thus generated as having its own harmonic foundation, its own "fundamental note." As he himself tells us, the *bass* is "the foundation of the harmony." For Zarlino, therefore, while *c* is the fundamental note of the harmony *c-e*, the fundamental note of its inversion *e-c'* is not *c* but *e*; and this is why he describes the major Third, as *c-e*, as a very good consonance, but its inversion *e-c'* as a very poor one. How great is the difference here between the point of view of Zarlino and that of Rameau, for whom both consonances represent but different aspects of the same harmony, that is, have the same harmonic meaning. The reason is, of course, because the latter theorist perceives that *c* is the fundamental note of both harmonies, and in both cases relates *e* to *c*. Zarlino on the other hand feels that the lowest note *e* is the foundation of the harmony *e-c'*—although it is not the real "fundamental note" in Rameau's sense of the term—and relates *c'* to *e*, whereby the harmony *e-c'* obtains, as it needs must, a quite different harmonic meaning and character from that of the harmony *c-e*, and this quite apart from any question of key, or of the position which the interval *e-c'* may have in the scale. This aspect of the matter was one quite overlooked by Rameau.

So also with the interval of the Fourth. No sooner has Zarlino affirmed this Fourth to be consonant, seeing that it is the inversion of the Fifth, than he treats it as a dissonance: it may be used between two upper parts (*a*), but is dissonant if heard between the *bass* and an upper part (*b*):—



In the same chapter we read that the Sixth, especially the minor Sixth, almost approaches a dissonance in effect.¹ And yet there is little question but that Zarlino, and other composers of and before his time, were quite well aware of the resemblance in harmonic effect existing between the harmony *c-e-g* and the harmony *e-g-c'*; in this connection

¹ "Imperochè sì come la Sesta *per sua natura* non è molto consonante, & è men buona della Terza, massimamente della maggiore: come si vede che non la lasciate ne i Contrapunti dimorare in un luogo per molto tempo, perch' offende il senso." (*Dimos. Harm. Ragion Seconda* Def. X.)

the part played by the "Faux-bourdon" in the evolution of polyphonic music is of especial significance. Yet Zarlino treats the Fourth and Sixth as "original," *i.e.*, non-inverted intervals. The reason is obvious. Both intervals possess their own peculiar effect, and both are generated from the *senario*. It is as impossible for Zarlino to explain the Fourth as having its "origin" in the Fifth, or the minor Sixth in the major Third, that is, as arising from the principle of inversion, as it is for him to consider the ratios $3:4$ and $5:8$ to have their "origin" in the ratios $2:3$ and $4:5$. And if this is true of intervals, it is even more true of chords. But Zarlino, as will soon be evident, has no suspicion that such things as inverted chords exist.

In Chapter 10, Part III., of the *Istituzioni* we find a noteworthy passage in which Zarlino shows us that he considers that arrangement of the consonances which corresponds to the harmonic progression of numbers to be the only *natural* one; the other (arithmetic) is, so to speak, contrary to the natural order. In this chapter he asks why some melodies or compositions (*Cantilene*) sound bright and cheerful, while others are somewhat sad or plaintive in effect. He also distinguishes between the Modes in a similar manner. Some of the Modes are bright in character (*allegro*), the others are somewhat mournful (*mesto*); that is, he demonstrates the major or minor character of the Modes according as the major or minor Third is heard above the *Final* of the Mode. "The reason is," he says, "that in the first the *major* consonances appear above the Final, as in the 1st, 2nd, 7th, 8th, 9th and 10th Modes or Tones; thus these Modes are bright in character; for in them we see the consonances arranged according to the nature of the sonorous number, that is to say, the Fifth is divided harmonically into a major Third and a minor ($4:5:6$), which is extremely pleasing to the ear. I say that here the consonances are arranged according to the nature of the sonorous number. for then the consonances appear in their natural places. . . . In the other Modes, which are the 3rd, 4th, 5th, 6th, 11th and 12th, the Fifth is placed in the opposite direction, that is divided arithmetically ($6:5:4$), so that many times we hear the consonances arranged contrary to the nature of the number in question. In the first (the Modes first mentioned), the *major Third* is frequently placed *below the*

minor; whereas in the second the contrary is the case [that is, the minor Third is placed below the major], and a certain mournful or languid effect is produced, so that the whole melody has a certain softness of character (*molle*)."

With regard to these Church Modes, it must be understood that Zarlino's classification of them is as follows:—

I.	II.	III.	IV.	V.	VI.
Ionius.	Hypoionius.	Dorius.	Hypodorius.	Phrygius.	Hypo- phrygius.

VII.	VIII.	IX.	X.	XI.	XII.
Lydius.	Hypo- lydius.	Mixo- lydius.	Hypomixo- lydius.	Aeolius.	Hypo- aeolius.

in which the odd numbers represent the Authentic, and the even numbers their corresponding Plagal Modes; the 1st, 2nd, 7th, 8th, 9th and 10th Modes have a major Third and perfect Fifth above the Final, whereas the 3rd, 4th, 5th, 6th, 11th and 12th Modes, have a minor Third and perfect Fifth.

It is not difficult to understand how it is that Zarlino comes to make this new and important distinction between the Modes. He is struck with the mysterious, somewhat mournful effect of the minor Third which appears above the Final, which so strongly contrasts with the bright *major* effect of the major Third when heard above the Final. He endeavours to find a reason for this, but he cannot find it in any principle of harmonic generation which he has so far brought to light. He has shown that all the simple consonances, including the minor Third (5:6), result from the *senario*, as well as from the harmonic division of the Octave and of the Fifth. But in neither of these principles of generation of consonances is he able to discover any explanation of the peculiarly *minor* effect which may be produced by the minor Third. For one thing, he clearly observes that it is only in certain circumstances and under certain conditions that this minor Third produces a *minor* effect. For example, the minor Third *e-g* is present in the harmony $\begin{smallmatrix} 4:5:6 \\ c-c-g \end{smallmatrix}$; nevertheless the effect of this harmony is not

minor, but *major*; the same minor Third $c-g$ is present in the harmony $\frac{6:5:4}{c-g-b}$; in this case the harmony is *minor*. Both harmonies are composed of the same intervals; each consists of a major Third (4 : 5) and a minor Third (5 : 6) which together make up the perfect Fifth (2 : 3). Zarlino however perceives that while in the first chord the minor Third occupies the higher position, in the second chord it occupies the lower position. The difference in the effect of the two harmonies is therefore, he considers, owing to the difference in the disposition of the Thirds of which they are composed; the minor Third does not in itself invariably produce a *minor* effect, for the minor Third is present in the major harmony; this can only happen when it occupies the lower position in the harmony. So then, Zarlino remarks, while the Fifth never changes but has always the same proportions (as $\frac{2:3}{c-g}$ or $\frac{3:2}{c-b}$), the Thirds do change, not with regard to their proportions, but with regard to their position within this Fifth. If the major Third occupies the lower position, the harmony is Major (*allegra*); if on the other hand it occupies the higher position, the harmony is Minor (*mesta*). The difference in the harmony is therefore owing to the difference in the disposition of the two Thirds.¹

¹ "Ma perche gli estremi della Quinta sono invariabili et sempre si pongono contenuti sott' una istessa proportionione (lasciando certi casi ne i quali si pone imperfetta) però gli estremi delle Terze si pongono differenti tra essa Quinta, non dico però differenti di proportionione ma dico differenti di luogo: percioche (come hò detto altroue) quando si pone la Terza maggiore nella parte graue l'Harmonia si fa allegra: & quando si pone nell' acuto si fa mesta. Di modo che dalla positione diuersa delle Terze, che si pongono nel Contrapunto tra gli extremi della Quinta, . . . nasce la varietà dell' Harmonia." (*Ist. Harm.*, Pt. III., Cap. 31.)

Dr. Riemann has unfortunately failed to quote Zarlino correctly; he makes him say: "però gli estremi della Terza si pongono differenti tra essa Quinta," etc. (*Geschichte der Musiktheorie*, p. 373). In this case, Zarlino appears to refer to one Third only, and some colour is certainly given to Dr. Riemann's assertion that he distinguishes only one kind of Third (4 : 5). Zarlino, however, uses not the singular but the plural number (*delle Terze*), and speaks not of one but of both the Thirds. The whole passage presents not the slightest difficulty. What Zarlino actually tells us is, that while the Fifth never alters (except in the case of the diminished Fifth) but is always represented by the same proportions, the Thirds which are placed within this Fifth do undergo alteration, not with regard to their

It is from this passage that Dr. Riemann has argued that Zarlino actually distinguishes only one kind of Third, namely the major Third, and has given him on this account a place among the representatives of our newest school of modern theorists (Hauptmann, Öttingen, Riemann, etc.). "I have on frequent occasions," Riemann remarks, "called attention to the fact that Zarlino, in the same way as Francisco Salinas, Rameau, Tartini, etc., and in our own day Moritz Hauptmann, distinguishes not two kinds of Third, but only one and the same proportion of Third (5 : 4) as the constitutive element of the minor as well as of the major harmony."¹ Dr. Riemann however has no better grounds for this assertion than a line or two from Zarlino, which he misquotes, and in which Zarlino is made to speak of one Third only, when in reality he refers to both the Thirds. It must certainly appear astonishing that Zarlino should make such an assertion as that there is but one species of Third which divides the Fifth either harmonically or arithmetically, for this reason, among many others, that this startling statement occupies only a line or two of the chapter in which Dr. Riemann supposes it to occur, and not only is not repeated in any other portion of his works, but meets on the contrary, with the most positive contradiction.² Nowhere does Zarlino state, or even suggest, that there is but one species of Third; throughout his works he repeatedly and

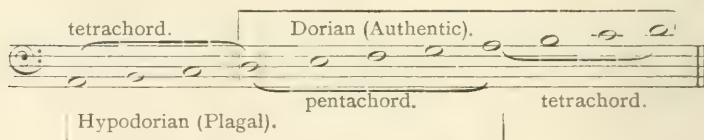
proportions, but with regard to their position, and the whole matter becomes perfectly clear by a glance at the diagram which appears immediately above the passage in question (see p. 49). In the one harmony the major Third appears in the lower part, and in the other in the higher part; while the minor Third is in the higher part in the one harmony, and in the lower part in the other. But while the Thirds thus alter their positions, they do not alter their proportions.

¹ *Geschichte der Musiktheorie*, p. 373.

² Rameau is perfectly familiar with this chapter, and in treating of the major and minor harmonies he uses language very similar to that of Zarlino. He frequently states that the only difference between the major and the minor harmonies is in the different disposition of the Thirds. "The only difference is in the disposition of the Thirds which together make up the Fifth; the Third which is major in one case being minor in the other." (*Traité*, Bk. I., Ch. 8, Art. 2.) "As for the harmonic and arithmetical proportions, the first divides the Fifth so that the major Third is at the bottom and the minor Third at the top; whereas, according to the second proportion, the minor Third is at the bottom and the major Third at the top." (*Traité*, Bk. I., Ch. 3, Art. 5.)

expressly asserts that there are two kinds of Third, a major and a minor. Even in the same chapter as that from which Dr. Riemann quotes, we read: "We may secure greater variety in the harmony (although this is more necessary in composition for two voices than in that for several voices) by placing the different Thirds in the following manner. Having first taken the major Third, which arises from the harmonic division, we may take after it the minor Third, which arises from the arithmetical division."¹ Here Zarlino not only considers the minor Third to be a distinct species of interval, but explains it as being different in its origin from the major, and as resulting from the arithmetical division of the Fifth.

Having satisfied himself that the strongly contrasted effect of the minor as compared with the major harmony is owing to the different disposition of the Thirds which together make up the Fifth, Zarlino now finds his way clear. Already Glarean (*Dbdecachordon*, 1547) had pointed out that the time-honoured division of the Modes into Authentic and Plagal was one which was theoretically justifiable. As is known, every Authentic and Plagal Mode was considered to consist of a pentachord and a tetrachord; but while in the former the tetrachord occupied the higher position, in the latter it occupied the lower position; that is, the positions of pentachord and tetrachord were reversed:



In other words, the Authentic Mode consisted of a Fifth and a Fourth; the Plagal, on the other hand, of a Fourth and a Fifth. But such an arrangement, Glarean pointed out, exactly corresponded to the harmonic and the arithmetical division of the *Octave*; for the harmonic division of the Octave *d-d'*,

¹ Se adunque noi porremo variar l'Harmonia & osseruare più che si può la Regola posta di sopra nel Cap. 29 (ancora che nelle composizioni di più voci non sia tanto necessaria, quanto è in quelle di due) è di bisogna, che noi poniamo le *Terze* differenti in questa maniera: c'hauendo prima posto la *Terza maggiore*, che faccia la *mediatione Harmonica*, poniamo dopo la *minore*, che farà la *divisione Arithmetica*." (*Ist Harm.*, Pt. III., Cap. 31.).

gives the following result : $\overbrace{d}^{5\text{th}} - \overbrace{a}^{4\text{th}} - d'$; while the Octave $a-a'$,

arithmetically divided, is $\overbrace{a}^{4\text{th}} - \overbrace{d}^{5\text{th}} - a'$. Zarlino, for the theore-

tical explanation of the new distinction he is drawing between the Modes, now carries this process a step further, and applies it to the *Fifth*. Both major and minor harmonies consist of a major and a minor Third, but with positions reversed. This exactly corresponds to the harmonic and arithmetical division of the Fifth, for the Fifth $c-g$, harmonically

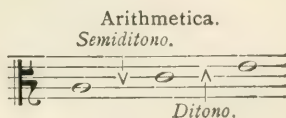
divided, is $\overbrace{c}^{\text{Maj. 3rd}} - \overbrace{e}^{\text{Min. 3rd}} - \overbrace{g}^{\text{Fifth}}$; while the Fifth $a-e$, arithme-

tically divided, is $\overbrace{a}^{\text{Min. 3rd}} - \overbrace{c}^{\text{Maj. 3rd}} - \overbrace{e}^{\text{Fifth}}$.

This distinction constitutes for Zarlino a new means of obtaining variety of the harmony. He has frequently pointed out that harmony is the result of the union, not of like, but of unlike or diverse elements. The composer should bear this in mind, for it is in the variety or diversity of the harmony that its perfection consists. But the variety of the harmony, or harmonic material, at the disposal of the composer consists not only of the various consonances which arise from the *senario* ; another means of variety consists in the arithmetical as well as the harmonic division of the Fifth. Zarlino explains this in a passage to which great prominence is given by Dr. Riemann, and which it is necessary to quote. In the chapter from which the passage is taken, Zarlino gives the following diagram :—



E



and remarks: "The variety of the harmony does not consist *solely* in the variety of the consonances which two voices form with each other, but *also* in that variety of the harmony which is determined by the position which the Third or the Tenth occupies above the lowest note of the chord. Either this Third is minor, and the harmony to which it gives rise is determined by or corresponds to the arithmetical proportion; or it is major, and the harmony corresponds to the harmonic proportion. It is on this variety that all the diversity and perfection of the harmony depend. Perfect harmony demands that the Third and Fifth, or their compounds (the Tenth and Twelfth) be actually (*in atto*) present; for besides these two consonances the ear desires no further sounds which could render the harmony more perfect."¹

Of this passage Dr. Riemann has given a free, a somewhat too free, translation. He imagines that Zarlino here states that "the essential content of polyphonic music is to be found, not in the numerous consonances, but rather in the distinction between the two possible forms of harmony"² (that is, the major and minor harmonies);

¹ "Conciosia che la varietà dell' Harmonia in simili accompagnamenti non consiste *solamente* nella varietà della Consonanze che si troua tra due parti, ma nella varietà *anco* dell' Harmonia, la quale consiste nella positione della chorda che fa la terza, ouer la Decima sopra la parte graue della cantilena. Onde, ouer che sono minori & l'Harmonia che nasce è ordinata ò s'assimiglia alla proportionalità ò mediatione Arithmetica, ouer sono maggiori & tale Harmonia è ordinata ouer s'assimiglia alla mediocrità Harmonica: & da questa varietà dipende tutta la diversità & la perfettione dell' Harmonia. Conciosia che è necessario (come dirò altroue) che nella Compositione perfetta [or *Harmonia perfetta*, cf. note p. 54] si ritrouino sempre in atto la Quinta & la Terza ouer le sue Replicate, essendo che oltra queste due Consonanze l'Udito non può desiderar suono che caschi nel mezo ouer fuori de i loro estremi che sia in tutto differente & variato da quelli." (*Ist Harm.*, Pt. III., Cap. 31.)

² "Nicht in der Mannigfaltigkeit der Konsonanzen, welche je zwei Stimmen bilden, sondern vielmehr in der Unterscheidung der beiden möglichen Formen der Harmonie der eigentliche Inhalt des mehrstimmigen Tonsatzes zu suchen ist" (*Gesch. der Musiktheorie*, p. 369). By this passage Dr. Riemann evidently means to say that Zarlino recognizes the major and minor harmonies to constitute the sole harmonic material of polyphonic music; otherwise his language is meaningless; for "the essential content of polyphonic music" cannot be held to consist in a mere "*distinction*" between two different kinds of harmony. A little later, however, he makes his meaning clear, when

and that "the Third and Fifth, and their inversions, constitute the sole (harmonic) elements of composition."¹ Dr. Riemann, however, reads into Zarlino's language what it certainly does not contain, and gives a wrong impression both as to what Zarlino has actually said, and as to what he actually means. Zarlino does not state, nor even imply, that the major and minor harmonies constitute the sole harmonic material of polyphonic composition. He is speaking of the variety of the harmony, and of the means by which this variety may be obtained. This variety does not consist *solely* (*solamente*) in the various consonances, but *also* (*anco*) in the quality of the Third which appears above the lowest note of a chord. In order to give to his assertion some degree of probability, Dr. Riemann is obliged to assume that Zarlino is acquainted with the inversion of chords, and that he distinguishes between chords which are fundamental and chords which are inverted. (See p. 36.) But these are mere assumptions; they have no basis in fact, nor is Dr. Riemann able to bring forward any real evidence in support of them. He thinks that by *Replicati* Zarlino understands *inversions*. (See p. 36.) But Zarlino distinctly defines *Replicati* as "intervals which are larger than an Octave," that is, the compound forms of simple intervals, and nowhere throughout his works does he attach any other meaning to the term.² Nor does Zarlino anywhere suggest that he considers the Third and Fifth to be "the only elements of composition." He says expressly the opposite.³ "The elements of composition" (*contrapunto*), he states, "are of two kinds, Simple and Compound (*Replicati*). The simple

he states that Zarlino's words can only be interpreted in the sense that "except the major and minor chords, no other ground-harmonies exist" ("Zarlino's Satz, dass alle Verschiedenheit der Harmonie in der Einstimmung der Terz beruhe, gewinnt den fundamentalen Sinn, dass es ausser dem Dur- und Mollaccord keine Grundharmonien giebt.") (*Ibid.* pp. 372-373.)

¹ "Die Terz und Quinte oder ihre Oktavversetzungen sind die alleinigen Elemente der Komposition." (*Ibid.*, p. 370.)

² "La onde dico, che gli Elementi del Contrapunto sono di due sorti: Semplici & Replicati. I Semplici sono tutti quelli Intervalli che sono minori della Diapason: com'è l'Vnisono, la Seconda, etc. . . et li Replicati sono tutti quelli che sono maggiori di lei: come sono la Nona, la Decima, etc. . (*Ist. Harm.*, Pt. III., Cap. 3.)

³ *Ibid.*

intervals are all those which are less than an Octave ; as the Unison, the Second, the Third, the Fourth, the Fifth, the Sixth, the Seventh, and the Octave [!] ; the compound intervals are all those which are larger than an Octave ; as the Ninth, the Tenth, the Eleventh, the Twelfth, and so on." But in fact Dr. Riemann, in his eagerness to include Zarlino as one of the foremost representatives of the "newer school" of harmonic science, not only quite mistakes the real drift of his remarks, but fails to grasp the real nature of the important theoretical pronouncement which he makes. What Zarlino is chiefly concerned to demonstrate is that there is a certain position of the harmony which excels all others—the *Compositione*- or *Harmonia-perfetta*. In this the ear desires no further sound which could render the harmony more perfect.

Rameau, to whom this passage was well known, employs Zarlino's language, and borrows his terms. In the "perfect harmony" (*accord parfait*) he states, we find only the Third and Fifth, or their compounds. It is so called because it is "the most perfect that the ear can imagine."

Further, Dr. Riemann has no ground whatever for his extraordinary assertion that Zarlino recognizes the highest note, that is the Fifth, of the minor harmony, as well as the lowest note of the major harmony, to be the fundamental note. It is true, and it is important to note, that Zarlino defines the bass as "the Basis or foundation of the harmony, because it forms the support of all the other parts."¹ But Zarlino has nothing to do with "ground-harmonies" or "fundamental notes" in our or in Rameau's sense of the term. For like the figured bass practitioners a century later he regards the bass as the foundation of every combination heard above it, whether this represents an inverted chord or not. And if Zarlino was unable to distinguish correctly the fundamental note of an inverted major harmony, it is unlikely, to say the least, that he should prove himself to be a more advanced theorist than Rameau himself, and even of Helmholtz, in respect of the minor harmony.

¹ "Et si come la Terra è posta per fondamento de gli altri Elementi: così 'l Basso hà tal proprietà, che sostiene, stabilisce, fortifica, & da accrescimento all' altre parti : conciosiache è posto per Basa & fondamento dell' Harmonia : onde è detto Basso, quasi Basa, & sostenimento dell' altre parti." (*Ist. Harm.*, Pt. III., Cap. 58.)

If we summarize the foregoing, we find that Zarlino is acquainted with the principle of Octave inversion, but does not explain any of the intervals as arising from this principle; while of inverted chords he knows nothing. He does not consider any consonance or harmony to arise from the principle of harmonic inversion. He is not to be regarded as the real progenitor of the Hauptmann-Öttingen, etc., school of modern theorists who recognize only one species of Third as "directly intelligible." He does not consider the Fifth of the minor Triad to be its fundamental note. He does not state that the Third and Fifth are the only elements of composition. Finally, he knows nothing of "ground-harmonies," nor does he state that the only fundamental harmonies which exist are the major and minor chords. In short, it is impossible to consider Zarlino as a more advanced theorist than Rameau himself, or as one of the most illustrious exponents of the "newer school" of harmonic science.

Still, the real theoretical achievements of Zarlino are of much importance; and it remains to be stated, as briefly as possible, what it was that Zarlino actually accomplished. In the first place, Zarlino classifies and systematizes the harmonic material in use in his time. This consisted of a large number of intervals, dissonant as well as consonant. The dissonant intervals, Zarlino demonstrates, have no real separate existence apart from the consonances; nevertheless the dissonant intervals have a well-defined function, for they not only retard but enhance the harmonious effect of the various consonances. Of the consonant intervals, some are compound (*Replicati*) and are to be regarded merely as repetitions of the simple intervals. The identity of harmonic significance existing between a compound and a simple interval is owing to the nature of the Octave, which resembles, and may be said to represent, the principal sound. All the consonances arise either directly or indirectly from the *senario*, the most perfect being those which are nearest to Unity. The consonances therefore do not arise arbitrarily, but depend for their origin on a certain fixed and definite principle, which at the same time determines their varying degrees of perfection. This principle is a mathematical one, and is contained in the *senario*. For Zarlino therefore the *senario* is the "natural principle" of harmony, and of harmonic generation.

Zarlino also shows that while some of the Modes are major in character, the others have a minor effect. This is owing to the quality of the Third which appears above the Final. Either the Third is major, and it arises from the harmonic division of the Fifth; or it is minor, and arises from the arithmetical division. The minor harmony is less harmonious and perfect than the major; the reason being that in the minor harmony we find the consonances arranged "contrary to the nature of the sonorous number."

Although Zarlino does not treat of "chords" in our sense of the term, but of consonances, and of the various ways of combining them,¹ he nevertheless recognizes that there are certain combinations of consonances which sound fuller and more harmonious than any other.² The most perfect combination is that which consists of a Third and Fifth, or their replicas (the Tenth and Twelfth). This combination is regarded by Zarlino as being worthy of a distinctive name. He calls it the *harmonia perfetta*. It is noteworthy that he assigns as the reason for its "perfection" not the blending of its sounds together in such a way as to convey to the mind the impression of a harmonic unity, but the "diversity" of its sounds, which produce on the mind a sense of the greatest possible harmonic "variety."³ He advises the composer to make use of this "perfect" harmony wherever possible. It is true, he admits,

¹ Thus Rameau says:—"The error of Zarlino in the application of his rules is, that he considers not more than two parts at a time." (*Traité de l'harmonie*, Bk. II., Ch. 14.)

² See the concluding part of the quotation from the *Ist. Harm.*, p. 50 (footnote).

³ "Oltra di questo è da auertire, che quella Compositione si può chiamar Perfetta, nella quale in ogni mutatione di chorda, tanto uerso 'l graue, quanto uerso l'acuto, sempre si odono tutte quelle Consonanze, che fanno varietà di suono ne i loro estremi. Et quella è veramente *Harmonia perfetta* ch' in essa si ode tal consonanze; ma i Suoni ò Consonanze che possono far diversità al sentimento sono due, la Quinta & la Terza, ouer le Replicate dell' una & dell' altra: percioche i loro estremi non hanno tra loro alcuna simiglianza, come hanno quelli dell' Ottava: essendo che gli estremi della Quinta non movono l' Udito nella maniera, che fanno quelli della Terza, ne per il contrario. . . . dobbiamo per ogni modo (accioche habbiamo perfetta cotale harmonia) cercare có ogni nostro potere, di fare udir nelle nostre Compositioni queste due consonanze più che sia possibile, ouer le loro Replicate." (*Ist. Harm.*, Pt. III., Cap. 59.)

that many composers put the Sixth in place of the Fifth. This is quite permissible, and is even to be recommended; but it is quite evident that he considers the Sixth to be much less harmonious and "perfect" than the Fifth.¹ In thus considering the Sixth to be a somewhat imperfect substitute for the Fifth, Zarlino demonstrates how far he is removed from any conception of inverted chords, or from any suspicion that the chord of the Sixth, *e.g.*, *c-e-a*, represents, not an "altered" major harmony *c-e-g*, but is itself the first inversion of the "perfect" minor harmony, *viz.*, *a-c-e*.

Further, Zarlino defines the bass to be the real support and foundation of the harmony. It is the "basis" of the harmony, because it resembles the earth, which forms the support of the other elements. This, it is true, is not a sufficiently exact theoretical explanation. Nevertheless, this recognition of the nature and function of the bass represents a fact of the greatest importance for the science of harmony. Zarlino's definition may quite well have been, and indeed was in reality, the expression of what had been gradually revealing itself to the consciousness of composers. But, as already stated, the "foundation of the harmony" of Zarlino has not the same meaning as the "fundamental note" of Rameau. For Zarlino "fundamental note" and "bass note" are equivalent terms.

The historical position of Zarlino is quite well understood. He stands just at the close of the great polyphonic period of music; his works constitute a vast exposition of the principles and practice of the masters of composition of that period. But what exactly is his theoretical position? We have seen how he recognizes that there is a certain harmonic combination which excels all others. It takes a place by itself. It is the "perfection" of harmony; the

¹ "E ben vero, che molte volte i Prattici pongono la Sesta in luogo della Quinta, & è ben fatto. Ma si de auertire, che quando si porrà in una delle parti la detta Sesta sopra'l Basso, di non porre alcun' altra parte che sia distante per una Quinta sopra di esso: perciocche queste due parti uerrebono ad esser distanti tra loro per un Tuono, ouer per un Semituono, di maniera che si udirebbe la dissonanza. (See also footnote on page 50). . . . Osservuarà adunque il Compositore questo, c'hò detto nelle sue compositioni: cioè, di far più ch'ello potrà, che si ritroui la Terza, & la Quinta, & qualche siate la Sesta in luogo di questa, ò le Replicate: accioche la sua Cantilena venghi ad esser sonora & piena." (*Ist. Harm.*, Pt. III., Cap. 59.)

Harmonia Perfetta. We have seen also that the chief work of Zarlino has been to classify and to reduce to its ultimate source the entire harmonic material of polyphony, consisting of the various intervals, consonant and dissonant. What is the net result of his labours, and what is the net result, so far as harmony is concerned, of the strivings of generations of composers, of the artistic labours of centuries? It is this *Harmonia Perfetta*, for as Zarlino himself points out, if all the sounds represented by the terms of the *senario* be heard together, there results from such an arrangement of the consonances, not a clashing of sounds, but a harmony of the most pleasing character.¹

Zarlino's position as a theorist, indeed, is in entire accord with the nature of polyphony itself. The essence of polyphony is its diversity, and the problem of polyphony is to bring together those diversified elements in such a way that there shall result a certain harmoniousness of character and of effect. Zarlino's task as a theorist was to reduce the great "variety" and "diversity" of already existing harmonic elements to a definite and rational principle. That the result of his labours should be the *Harmonia Perfetta*, represented by the terms of the *senario*, is evidently for him a wonderful circumstance. He cannot explain it, for it is a result he certainly did not contemplate when he set about his task of reducing the harmonic elements of polyphony to a rational order. But it is for Zarlino a circumstance of deep significance. It is a circumstance no less remarkable for the history of music than for the science of harmony. For the *Harmonia Perfetta*, the consummation from the harmonic point of view of this great polyphonic period of music, the end also of Zarlino's work as the theorist, the greatest and most representative, of the polyphony of his time, is the starting-point of the new harmonic period of music which was shortly to be ushered in; it is the starting-point also of Rameau's theory of harmony, his principle of principles.

¹ "Et sono queste parti in tal modo ordinate, che quando si pigliassero sei chorde in qual si voglia Istrumento, tirate sotto la ragione de i mostrati Numeri, & si percuotessero insieme, ne i Suoni, che nascerebbono dalle predette chorde, non solo non si udirebbe alcuna discrepanza, ma da essi, ne uscirebbe una tale Harmonia, che l'Vdito ne pigliarebbe sommo piacere." (*Ist. Harm.*, Pt. I., Cap. 15.)

These are important facts, the significance of which, by musical historians and musical theorists generally, has been passed over unobserved. We have here a picture which touches the imagination; here if anywhere we find a veritable romance of musical history and science. Zarlino, the learned and pious *maestro*, stands like an aged Simeon between two great epochs; he holds in his arms the fruit of the striving of centuries, the principle from which shall proceed a new artistic creation. He himself belongs to the old order of things, but he looks forward into the new.

RENÉ DESCARTES (1596-1650) (*Compendium Musicae*).

The *Compendium Musicae* (1618) of René Descartes appears to have been as familiar to Rameau as the more voluminous writings of the learned Venetian master. This little treatise, written when its author was only twenty-two years of age, is in many respects a remarkable work.¹ Descartes, as might be expected, proves himself to be possessed of an acute faculty of precise scientific observation. He refers in several places to the natural phenomena of harmonics and of sympathetic vibration. Thus of the overtone of the Octave he says: "We never hear a [musical] sound but its upper Octave appears also to strike the ear in a certain measure." Not only so; this Octave sound reinforces the fundamental sound² (combination tones!). The Octave is the first and most perfect of the consonances; not only is it the first consonance to arise from the senary division of a string, that is, of a string divided successively by the first six numbers, but in such instruments as the flute it is the first harmonic sound to be obtained; the Fifth (Twelfth) arises only after the Octave. There is no consonance which is in reality larger than an Octave; for intervals which exceed the Octave are "composite" intervals, and consist of an Octave and a simple interval. Further, all the consonances are contained within the Octave; for

¹ It was not published until after the death of its author in 1650.

² Unde præterea sequi existimo nullum sonum audiri, quin hujus octava acutior auribus quodammodo videatur resonare, unde factum est etiam in testudine, ut crassioribus nervis, qui graviore edunt sonos, alii minores adjungerentur una octava acutiores, qui semper una tanguntur & efficiunt, ut graviore distinctius audiantur." (*De Octava*.)

from the harmonic division of the Octave there arise the Fifth and the Fourth, and from the harmonic division of the Fifth, the major and the minor Thirds.¹ Descartes also points to the fact that if a string be set in vibration, other strings more acute, representing the Octave, Fifth (Twelfth) and major Third (Seventeenth) of the first sound, will be made to vibrate, and to sound along with it.

It is by means of the arithmetical division of a string, Descartes states, that we obtain all the consonances. But in dealing with these consonances he proceeds in a very different way from that of Zarlino. For he considers some of the consonances to arise directly, the others only by accident (*per accidens*). This it is true he cannot prove, any more than could Zarlino, from the division of a string by the first six numbers. He therefore adopts another method. As, he remarks, we never hear a sound but we hear at the same time its upper Octave, as $c-c'$, therefore we never hear a Fifth but the Fourth also is heard to be

present thus $\widehat{5^{\text{th}}} \widehat{4^{\text{th}}}$
 $c-g-c'$ So that, to use Rameau's language,

the Fifth is to be regarded as the "original" interval; the Fourth, on the other hand, as "derived" from it. This Fourth is in reality merely the "shadow" of the Fifth; it displeases, for it is the "shadow" and not the substance!² The Fourth indeed is the most imperfect (*infelicissima*) of all the consonances. Like the Fourth, which arises from the harmonic division of the Octave, the minor Third also is a consonance *per accidens*. "The minor Third arises from the major Third, as the Fourth from the Fifth." Descartes means that just as the Octave may be harmonically divided, so also may the Fifth; from the harmonic division of the Fifth there arise two intervals, the major and minor Thirds, of which the first is direct, and the second "accidental." Similarly the major Third may be harmonically divided; of the two intervals which arise from its division, the first, the major tone (8 : 9) is direct; the second, the minor tone

¹ *De Octava.*

² " ideoque maxime quarta illi displiceret, quasi tantum umbra pro corpore, vel imago pro ipsa re foret objecta." (*De Quarta.*)

(9 : 10) accidental (!). These distinctions, Descartes proceeds, are not merely imaginary ; they are confirmed by the phenomenon of sympathetic vibration ; for “ in the lute and other such instruments, if one of the strings be set in vibration, it will also cause to vibrate and to sound along with it other strings which represent the Fifth and major Third above it,” but none other. Whence it is manifest that the Octave, Fifth, and major Third are the only direct or “ original ” consonances ; the Fourth and the minor Third which proceed from these are consonances only *per accidens*. So that there are but three “ sonorous numbers ” namely, 2, 3, and 5, the first of which represents the Octave ; the second, the Fifth ; and the third, the major Third ;¹ the numbers 4 and 6 are merely compound forms of 2 and 3.

These observations of Descartes must have proved in the highest degree illuminating for Rameau. Descartes makes a noteworthy advance in the direction of Rameau’s theory of inversion. Not all the intervals have an independent origin ; some are “ derived ” intervals. His explanation of the Fourth as the “ shadow ” of the Fifth, an expression which is quoted by Rameau, is also Rameau’s explanation, but with a difference. For Descartes, strange to say, imagines that this explanation accounts for the dissonant effect of the Fourth ; on the contrary, the Fourth, as the “ shadow ” or inversion of the Fifth, ought to appear as one of the best of the consonances, and not the worst. The Fourth, when

heard along with the Fifth, thus $\widehat{5^{\text{th}}} \widehat{4^{\text{th}}}$ sounds almost
 $c — g — c'$

as consonant as the Fifth. Descartes then, although like Rameau he considers the Fourth to be “ derived ” from the Fifth, nevertheless fails to perceive that the Fourth when it represents the Fifth is a good consonance, and has a harmonic meaning similar to that of the Fifth.

In his treatment of the Fourth the resemblance between Descartes’ theory of “ original ” and “ derived ” intervals and Rameau’s theory of inversion begins and ends. As for

¹ “ In illa enim advertendum est tres esse duntaxat numeros sonoros 2, 3, & 5, numerus enim 4, & numerus 6 ex illis componuntur.” (*De Octava.*)

the two Sixths, although Descartes makes passing mention of the fact that the minor Sixth is the Octave complement of

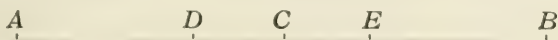
the major Third as $\widehat{3^{\text{rd}}} \widehat{6^{\text{th}}}$ he does not explain it, as
 $c - e - c'$

he might be expected to do after his treatment of the Fourth, as derived by inversion from the major Third; possibly for the reason that he would be unable to explain, in the same way, the major Sixth as derived from the minor Third, seeing that the minor Third is itself a "derived" interval. He does not regard either of the Sixths as "derived," but explains them, like Zarlino, as *composite* intervals. The major Sixth, he tells us, arises from the union of the major Third and the Fourth; the minor Sixth from the union of minor Third and Fourth. Descartes relates the major Sixth to the major Third, from which it proceeds; these intervals, he says, are similar in nature and effect; and in the same way he relates the minor Sixth to the minor Third.¹ In proceeding thus he succeeds, like Zarlino, in totally obscuring the real relationship of inversion which exists between the Sixths and the Thirds. Nevertheless, it was in the observations and suggestions thrown out by the philosopher Descartes that Rameau discovered some of the ideas from which were evolved the main principles which lie at the root of his theory of harmony. Descartes' treatment of the Fourth, and his statement that the only "sonorous numbers" are 2, 3, and 5, were for Rameau of the utmost significance.

Finally, it was Descartes' version of Zarlino's theory of the *senario* that furnished to Rameau his chief "fundamental principle" of harmony. The words of Descartes are thus quoted by Rameau at the beginning of his *Traité de l'harmonie*: "Sound is to sound as string to string; but each string contains in itself all others which are less than it, and not those which are greater; consequently every sound contains in itself those sounds which are higher, but not those which are lower. Whence it is evident that the

¹ "Sexta minor eodem modo fit a tertia minore ut major a ditono, & ita tertiæ minoris naturam & affectiones mutuatur, neque ratio est quare id non esset." (*De Ditono, Tertia minore, & Sextis.*)

higher term should be sought for by the division of the lower, and this division should be an arithmetical one, that is, one consisting of equal parts. If then in the following figure $A-B$ represent the lower term in which I wish to find the



higher, in order to form the first of the consonances, then I divide it in two (this being the first number), as has been done at the point C ; then $A-C$, $A-B$, are removed from one another by the first of the consonances, which is called Octave, or Diapason. Likewise if I wish to have the other consonances, which follow immediately on the first, I divide $A-B$ into three equal parts, from which will result not one acute term only, but two, namely $A-D$ and $A-E$, giving two consonances of the same kind, a Fifth and a Twelfth. I can still further divide the line $A-B$ into four, five, or six parts, but not more, because the capacity of the ear does not extend beyond this point"¹ (that is, the comparison of

¹ *De Consonantiis*. The actual words of Descartes are:—"quia scilicet aurium imbecillitas sine labore majores sonorum differentias non posset distinguere." Descartes' meaning according to Dr. Riemann (*Gesch. der Musiktheorie*, p. 456) is as follows:—From the harmonic division of the Octave there result the intervals of the Fifth and Fourth; from the harmonic division of the Fifth, there result the major and minor Thirds ($4:5:6$), and from the harmonic division of the major Third, the major and minor tones ($8:9:10$). Beyond this we cannot go, because already the diatonic semitone $15:16$ arises as the difference of the Fourth and major Third, and the chromatic semitone $24:25$ as the difference of the diatonic semitone and minor tone. As the chromatic semitone is the smallest interval known to melody, it is evident that the complex of consonances must be limited by the number 6, and that 7 and all higher intervals are theoretically inadmissible. This reasoning, however, is faulty; for if the two smallest intervals $15:16$ and $24:25$ are to be determined by the comparison of intervals derived from the harmonic division of the chief consonances, then the Pythagorean division of the monochord by the first four numbers only will furnish these intervals. The Fifth $2:3$, harmonically divided, produces the major Third $4:5$, and the minor Third $5:6$. If we compare these two Thirds, their difference will be the chromatic semitone $24:25$, while the diatonic semitone $15:16$, will represent the difference of Fourth $3:4$, and major Third $4:5$.

But Descartes, in the passage in question, is not thinking of the harmonic division of the consonances at all. What he really means is that from the comparison of the consonances which arise from the *senario* there result the smallest intervals which the ear is capable of

the different consonances arising from such a division of the monochord gives the smallest intervals of tone which the ear is capable of readily appreciating). With this statement of Descartes as his starting-point, then, Rameau proceeds to build up his theory of harmony. It is important to note that his point of departure was a mathematical, not strictly speaking an acoustical one. Of the series of overtones or harmonics, resulting from the natural divisions of a string or other sonorous body, he did not at this time appear to have been aware, at least they are not mentioned in the *Traité*, although they figure prominently in all his subsequent works. He indeed refers to the co-vibration of strings, but only in dealing with the Octave, or for the purpose of comparing the consonances of the Octave and Fifth.

appreciating without difficulty, and which are actually made use of for the degrees of the scale. Thus, in the chapter of his work entitled, "*De gradibus sive tonis musicis*," he says, "*Est autem probandum gradus sic spectatos ex inæqualitate consonantiarum generari.*" So that the major tone, 8 : 9, is the difference of Fourth and Fifth ; the minor tone 9 : 10 is the difference of Fourth and minor Third ; the diatonic semitone 15 : 16, the difference of Fourth and major Third ; and the chromatic semitone 24 : 25, the difference of major Third and minor Third ; this chromatic semitone being the smallest interval obtainable by such a comparison of the consonances, and the smallest melodic interval in use. Any smaller interval could be appreciated by the ear only with great difficulty. Understood in this sense, the argument of Descartes is much more convincing. But it does not adequately explain why the consonances should be limited by the number 6.

CHAPTER III.

JEAN PHILIPPE RAMEAU (1683-1764). *TRAITÉ DE L'HARMONIE*.

THE firstfruit of Rameau's reflections on the fundamental principles of harmony appeared in 1722, in which year he published his *Traité de l'harmonie réduite a ses principes naturels*, in some respects his most important work. It is divided into four Books. The first book treats of chords, ratios, and proportions, and the relationships which exist between them; the second, of the Fundamental Bass and of the nature and properties of chords; the third, of the Principles of Composition; and the fourth, of Principles of Accompaniment. An examination of Rameau's work inevitably leads to the conclusion that it is the result, not of one or two only, but of many years of reflection and research.¹ Although it does not represent his fully-matured theory—for some of his ideas are still in an embryonic state—it nevertheless contains the most essential of his principles, such as the Generation and Inversion of Chords, the Fundamental Bass, chords by "Supposition," and the relationship of Melody to Harmony. The reader who sets out to master the contents of the somewhat bulky *Traité de l'harmonie* has not an easy task before him. Rameau has poured out his ideas in a pell-mell confusion, with little order or arrangement. If as a composer his instrumental style is distinguished by the greatest clearness and precision, his literary style on the other hand is difficult, obscure, and diffuse. This, however, is evidently owing not so much to lack of literary skill as to the difficulties of the subject; for elsewhere Rameau could express himself in the most definite and lucid manner.

¹ The words of the Motet which Rameau has appended to the third book might be considered, in this connection, to be amusingly suggestive. They begin thus:—"Laboravi clamans, raucae factae sunt fauces meae."

The Preface to the *Traité* begins thus : " Whatever progress the art of music may have made amongst us, it would appear that the more the ear becomes sensible to its marvellous effects the less is the desire manifested to understand its true principles, so that one may say that reason has lost its rights, while experience alone has acquired any authority. The writings which remain to us of the ancients¹ sufficiently prove that reason alone has procured for them the means of discovering the greater part of the properties of music ; nevertheless, although experience makes us still approve of the majority of the rules which they have given us, we to-day neglect all the advantages that we might derive from reason in favour of empirical methods which relate solely to practice." Rameau has attempted, with more or less success, to cast his theory into a scientific form. He has approached his task in the spirit of the scientist, of the *savant*. His theoretical principles are to be *natural* principles ; they must have their source in Nature and have, therefore, all the certainty of natural laws. He has endeavoured, as he himself tells us, to free himself from all preconceived notions respecting the nature of harmony, all fettering constraint imposed by rules derived merely from tradition, from " custom and authority." Reason, truth, fidelity to Nature, these were the guides that he felt himself impelled to follow. In all this Rameau was undoubtedly strongly influenced by the intellectual forces of his age. It was indeed a time of brilliant intellectual achievement and progress, especially on the side of philosophy and mathematics. Before the end of the eighteenth century the discoveries and researches of Sir Isaac Newton in physics, of Harvey in physiology, of Locke in philosophy, had become known all over Europe. In Holland there were such names as Christian Huyghens,² mathematician and astronomer, who defined the wave theory of light ; and the brilliant philosophical genius Spinoza, who in his *Ethica* had already proclaimed to the world those philosophical propositions and demonstrations " for which," as Hume remarked, " he had become so universally infamous."

¹ That is, before the time of Zarlino, as Rameau himself explains.

² Huyghens must also be included in the ranks of musical theorists. He wrote *Novus Cyclus Harmonicus*, a work treating of musical temperament : also *Cosmotheros*, in which he treats of prohibited consecutives.

In Germany, Leibnitz, the apostle of the "pre-established harmony," had discovered the differential calculus. In France the influence of Descartes, whose *Discours de la Méthode* had appeared in 1637, had become especially widespread, and had penetrated far beyond the learned and scientific circles of Europe. Boileau, whose influence in literature and *belles lettres* was as powerful as that of Descartes in philosophy, had in his *L'art poétique* laid down the principle that *rien n'est beau que le vrai ; le vrai seul est aimable*. The poet should take reason, not imagination, as his guide ; and his aim should be—"fidelity to Nature."

In the anxiety of Rameau to rid himself of all prejudices, all preconceptions respecting the nature of harmony derived merely from tradition, the influence of the Cartesian "method" may easily be traced. "Has anyone so far sought in Nature," he asks, "some invariable and steadfast principle from which one may proceed with certainty, and which would serve as the basis of melody and harmony? Not at all! It has been a case rather of fumbling about, of compiling facts, of multiplying signs. After much time and trouble all that there was to show was a collection of phenomena without connection, and without succession ; . . . besides, the use of these phenomena is so arbitrary that he who is most familiar with them derives little instruction therefrom. Such was the state of matters when, astonished at the difficulty I experienced in acquiring whatever [theoretical] knowledge I had, I attempted to discover the means whereby such knowledge might be made more easy of attainment to others, and the art of composition rendered more certain and less laborious. It seemed to me that I could hardly fail, if I were successful in the one direction, to be successful also in the other, and that progress in the science of sounds would be assuredly less laborious when its principles were more certain. Enlightened by the *Méthode* of Descartes, which I had fortunately read, and with which I was much impressed, I began by subjecting myself to a process of self-examination. I attempted to put myself in the place of a child who tries to sing for the first time ; essayed various fragments of melody, and examined what were the effects produced on my mind and by my voice." ¹

¹ *Démonstration du principe de l'harmonie* (1750), pp. 6-8

At the beginning of his *Traité de l'harmonie*, Rameau quotes in full the passage from the *Compendium Musicae* of Descartes, which has already been given on p. 60, and draws therefrom the following conclusions:—

“That all the consonances are determined by the first six numbers; for the sounds produced by the whole string and its different divisions correspond to the notes *C, c, g, c', e', g'* (if *C* be taken to represent the sound produced by the entire string) in which, if the Octave *c''* be added, all the consonances will be found; for this reason all the force of harmony has been attributed to numbers”.

“That the origin and degrees of perfection of these consonances are determined by the order in which the numbers arise. Thus the Octave is the most perfect consonance; after it comes the Fifth, which is not so perfect as the Octave, then the Fourth, and so on.

“That the sounds which arise from these divisions of the string give, when heard together, the most perfect harmony that one can imagine.

“That all these sounds are generated from the whole string, or from its parts; but just as numbers must be related to Unity, which is the source of numbers, so must the different divisions of the string be related to the entire string in which they are contained; and the sounds arising from these divisions must be considered as being generated (*engendrez*) from the first or fundamental sound, which is therefore the source and foundation of all the other sounds. The harmony therefore resulting from the consonant intervals produced by the entire string and its divisions is not perfect unless this fundamental sound is heard below the other sounds; for this sound must appear as the principle or source of these consonances, and of the harmony which they form: it is their *base* and foundation.”¹

Following the examples set by Zarlino and Descartes, Rameau now examines at much length the nature and qualities of the consonant intervals which have thus arisen. Of the consonances generated from the principal sound, the Octave, the first and the most perfect consonance, is only a *replica* or repetition of this sound. Every *replica* is thus merged in its principle, and represents it. Male and female

¹ *Traité*, Book I., Ch. 3.

voices or men and boys, singing this Octave, appear to sing the same sound. In flutes and other such instruments this Octave depends on the pressure of wind (a slightly increased pressure of breath on the part of the player producing the harmonic sound of the Octave). Further, the perfection of the Octave is evident from the fact that it remains the Octave (or represents the same sound) whether one divides or doubles the term which represents it. Thus the same sound may be represented by 2, 1, or 4. Therefore the Octave ought not to be regarded as really differing from the fundamental sound from which it is derived; although naturally this fundamental sound has the greater importance attached to it.

From this identity of the Octave with the fundamental sound there arises the principle of *inversion*. Thus the Fourth is only a consequence of the Fifth, and is immediately derived from it. In the same way the minor Sixth is the inversion of the major Third, and the major Sixth is the inversion of the minor Third. This requires some further explanation. If we compare with the fundamental sound the other sounds which arise successively from the *senario* (excluding the Octave sounds, which are merely repetitions of sounds already existing) it will be found that the only intervals or consonances which thus occur are those of the Twelfth and Seventeenth. But as all that exceeds the Octave is merely the *replica* of what is contained within the Octave, consequently it is possible to reduce every interval to its smallest terms; therefore the Twelfth (reduced by one Octave) and the Seventeenth (reduced by two Octaves) are but the Fifth and Third. The Fifth and major Third, then, are the only consonances which arise directly from the fundamental sound. The Fourth and minor Sixth are derived from the Fifth and major Third by inversion. What then of the minor Third and major Sixth? These may be explained as follows:—The major Third divides the Fifth into two Thirds, a major and a minor. But as the major Third, in thus dividing the Fifth, necessarily generates at the same time the minor Third, this minor Third, and not only the major Third, must be considered to be generated directly!¹ The major Sixth, then, is derived by inversion from the minor

¹ *Traité*, Book I., Ch. 3., Art. 5.

Third. The three primary consonances are therefore the Fifth and the two Thirds; and the three secondary consonances derived from these are the Fourth and the two Sixths.

Not only intervals but chords may be inverted. Thus in the major harmony (as $c-e-g$), which is represented by the numbers $4:5:6$, if we place 4 an Octave higher we obtain the first inversion of the harmony, that is, a chord of the Sixth ($e-g-c'$), represented by the numbers $5:6:8$. If in the same way we place 5 an Octave higher, we obtain the second inversion of the harmony, a chord of the Fourth and Sixth ($g-c'-e'$), represented by the numbers $6:8:10$. We cannot however here carry the process of inversion further, for if we place 6 an Octave higher, we get a chord represented by the numbers $8:10:12$. But this proportion is the same as $4:5:6$, and indeed represents the original harmony itself. The first chord is called Perfect; the two chords derived from it are called Imperfect; for in the case of these derived chords the fundamental sound, c , is not in the bass; it is transposed, and represented by another sound, namely, its Octave.¹

This principle of inversion is the key to the diversity which characterizes harmony. Such inversion will modify the interval or chord, *without destroying its foundation*.

Already Rameau has treated of three of the most important principles of his theory of harmony, namely, the principles of Harmonic Generation, of the Fundamental note or Bass, and of the Inversion of Chords. He naturally deals first of all with the principle of Harmonic Generation. If there be no such principle, if music and harmony have no better origin or foundation than mere human caprice, there can be no intelligible system of harmony. We have seen however that the consonances which are actually used in music, which form the material of harmony and constitute the ultimate basis of all rational musical systems, do not depend for their origin on caprice. On the contrary, they are determined by certain numerical proportions which are as definite, precise, and invariable as any natural or scientific laws whatever. It has been objected that if the impression on

¹ *Traité*, Book I., Ch. 8.

the senses made by a certain harmony or interval depends on a certain definite and determined numerical relationship existing between the sounds which compose this harmony, one is utterly unconscious of it, until the attention has been directed to the fact by observation of the physical properties of the sonorous bodies themselves. This no doubt is quite true. In the same way, the eye may receive different impressions of colour without the mind being aware that these arise from luminiferous vibrations of varying rapidity. But ignorance of a fact does not necessarily imply its non-existence. One may pursue a fairly equable existence as a constituent portion of the universe without having heard, much less understood, anything of the correlation of forces. Even a child may sing various intervals in perfect tune without being aware that these intervals correspond to certain numerical ratios; just as there are many persons who could draw quite correctly all sorts and sizes of triangles, who would nevertheless be extremely nonplussed if they were asked to describe three angles which together should be equal to two right angles. But it should be noted that the question here is not primarily as to whether the effect produced on the ear and mind by harmony, or by the various consonances, is owing to the proportions which determine these consonances. The question is, does harmony arise arbitrarily, or from a fixed and definite principle? Zarlino, Descartes, Rameau, have all contended that harmony does arise from such a principle, which is certainly sufficiently definite, namely, the *senario* or series of numbers 1, 2, 3, 4, 5, 6. This principle of the determination of the consonances which are accepted as such by the ear is constant and invariable. The consonances are judged by the ear to be in perfect tune only when they correspond accurately with the acoustical determinations given by this principle. When this is not the case the consonance is said to be "out of tune," and when this "out-of-tuneness" is sufficiently pronounced, the effect produced on the ear is that of actual physical pain. This physical sensation of pain, in which the ear is torn, as it were, between the contending sounds, has its counterpart in Nature in the remarkable acoustical phenomenon of *beats*. Beats are, we might say, Nature's protest against the "false" consonance.

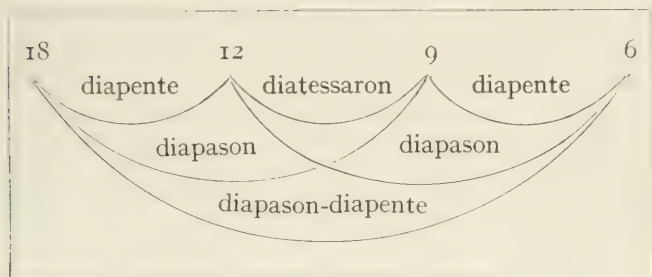
Of course we may, if we please, cherish the belief that all this is mere coincidence; that it is a mere chance that the consonances happen to correspond with the numerical series 1, 2, 3, 4, 5, 6, and that they are actually present in musical sound itself, even that of the human voice; but such a belief demands a much greater amount of credulity than is possessed by the average musician.

It has however been objected that in the prevailing system of equal temperament musicians constantly make use of intervals which are actually out of tune. But this is merely to confirm the laws relating to the acoustical determination of these intervals. Otherwise, in what sense can the tempered intervals be said to be "out of tune"? It is significant that a "tempered" interval is almost universally understood to mean, not an interval whose natural "out-of-tuneness" is removed by a process of "tempering," but one which, naturally in perfect tune, is placed *very slightly* out of tune, that is which differs, even if only to a small extent, from its acoustically determined proportions. However musicians may agree as to the necessity for equal temperament, few of them would contend, notwithstanding that they have been bred and brought up on the tempered scale, that a tempered Third or Fifth sounds better than the natural and untempered interval. A tempered major Third or perfect Fifth, in short, *stands for* and represents to the ear and mind the "natural" major Third or Fifth. A tempered major harmony, at the same time, is a poor substitute for the natural one, the almost ethereal effect of which, especially when produced by a capable body of singers, once experienced is not readily forgotten. Such a harmony, as Rameau has said, is as "perfect as can be imagined."

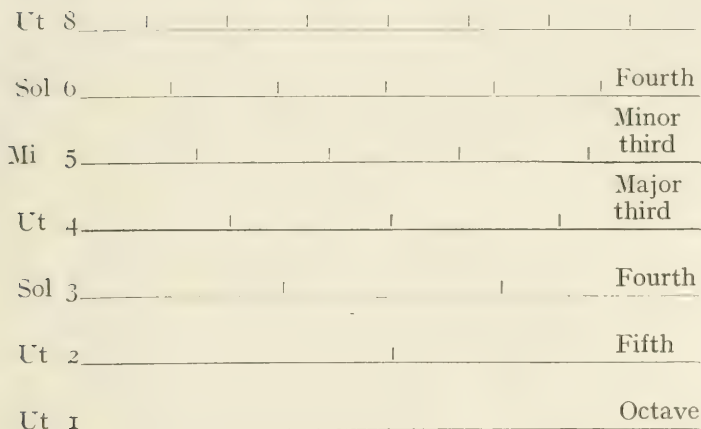
It is this "perfect harmony" (*accord parfait*), the *Harmonia perfetta* which represents the consummation of Zarlino's researches in the domain of harmony, that forms the starting-point of Rameau. While Zarlino argues from the consonances to the *Harmonia perfetta*, Rameau argues from the *Harmonia perfetta* to the consonances. Zarlino cannot arrive at unity except through diversity; Rameau cannot understand diversity except through unity. It is instructive to compare the first diagram given by Zarlino in his first theoretical work, the *1st. Harmoniche* (Pt. I., Cap. 7.)

with that given by Rameau at the beginning of his *Traité* :—

(ZARLINO.)



(RAMEAU.)



Of this diagram Rameau remarks :—" It should be noted that the numbers indicate always the division of Unity "; and if, like Zarlino, he afterwards treats of the various consonances, it is to show that these consonances are all derived from the " perfect " harmony, and that they have no other harmonic foundation. Rameau's addition of the number 8 to the

senario is in order to demonstrate that all the consonant intervals, including the minor Sixth (5 : 8), have their origin in the "perfect" harmony. But, as we have seen, Rameau does not consider the minor Sixth to be an "original" interval, but as derived by inversion from the major Third. This however is merely the first instance of the contradictions which abound in the *Traité*, just as his adding the number 8 so as to leave a gap in the arithmetical series between the numbers 6 and 8 is our first proof of the inferiority of Rameau as a logician to both Zarlino and Descartes.

To Zarlino the distinguishing characteristic of harmony was its "diversity." Rameau on the other hand recognizes almost from the outset its essential unity, and this becomes more and more clear to him as he proceeds.¹ It is noteworthy that Descartes, in his generation of the consonances, points expressly to the relationship which the Octave and Fifth—the major Third he includes later—bear

¹ Rameau seems to have considered that this view of harmony was shared by Zarlino. "Zarlino," he says, "has remarked that music is subject to arithmetic, and that Unity, which is the principle of numbers, represents to us the sonorous body, from which one derives the proof of the relationship of sounds; also, that the Unison is the principle of the consonances." Rameau then cites several chapters from Zarlino's *Istitutioni*. On examining these chapters, we find that Zarlino compares the Unison to unity. Unity, he proceeds, is not a number, but it is the beginning or source (*principio*) of numbers; so, likewise, the Unison is not a consonance, but it is the beginning, source, or starting-point of the consonances. The number 2, which expresses the Octave, *consists of two unities, or unity doubled*; the number 3, which express the Twelfth, is unity trebled, and so on. Rameau, therefore, is mistaken if he imagines that Zarlino considered the unison to represent "the fundamental sound, in which all the other sounds are contained"; just as he would have been mistaken had he considered Zarlino to have been familiar with the principle of the Fundamental Bass, or of "klang-representation." Zarlino leaves us in no doubt as to his actual meaning. In one of the chapters cited by Rameau he remarks: "The unison which is represented by unity is to Music what the point is to Geometry"; and he goes on to explain that just as geometers have defined the line as consisting of a series of points, so Music may be said to consist of a succession of unisons. (*Ist. Harm.*, Pt. III., Cap. II.) Nevertheless, Zarlino's statement that unity represented the beginning or source of numbers and the Unison the source of the consonances, indicates how nearly he approached to the principle which forms the basis of Rameau's theory; at any rate, for Rameau it was a statement of intense significance; for him it possessed a meaning which it did not have for Zarlino.

to the principal sound, and regards this relationship as proved by the power of co-vibration existing between these two sounds and the principal sound in which they are contained.¹ But Descartes, as we have seen, is by no means of opinion that all the consonances generated from the *senario* have the same Fundamental Bass. The major Sixth he considers to be derived from the major Third; and the minor Sixth from the minor Third, by means of the addition of the Fourth, which he considers to represent a sort of imperfect Octave (*octava deficiens & imperfecta*) so that the Sixths appear as compound or "composite" forms of the Thirds.

For Rameau however, impressed as he is with the essential unity of the major harmony, the statements of Zarlino and Descartes have a new meaning. Zarlino had said that "the Unison is the source of the consonances, as unity is the source of numbers"; Rameau seizes upon this idea, and carries it firmly to its ultimate and strictly logical issue. Descartes had said, "As string is to string, so sound is to sound"; and Rameau finds in Descartes' application of the *senario* to the divisions of the string exactly what he stands in need of for the demonstration of the unity of the major harmony, and the relationships of its sounds. The sounds which arise in succession from the *senario* do not to Rameau, as they do to Zarlino, represent so many "unities." As the relationship of the half to the whole string in which it is contained, so is the relationship of the sound produced by this half to the sound of the whole string; and so for the other divisions. All the sounds of the major harmony are contained in, or proceed from, a single sound. This sound is the fundamental sound to which all the other sounds are related; it is the fundamental note, or Fundamental Bass, of the harmony. It is evident that Rameau was not at this time acquainted with the natural series of harmonics resulting from the resonance of a sonorous body; otherwise he would hardly have failed to point to it as a wonderful confirmation of his theory.

¹ Secundum ex duobus terminis, qui in consonantias requiruntur, illum, qui gravior est, longe esse potentiores, atque alium quodammodo in se continere: ut patet in nervis testudinis, ex quibus dum aliquis pulsatur, qui illo 8^{va} vel quinta acutiores sunt, sponte tremunt & resonant, graviore autem non ita, saltem apparenter: cujus ratio sic demonstratur. *Sonus se habet ad sonum ut nervus ad nervum*, etc. *De Consonantiis*. (See p. 60.)

Rameau's theories of harmonic generation and of the fundamental note are thus seen to be closely interwoven ; it is, in fact, impossible to separate them.

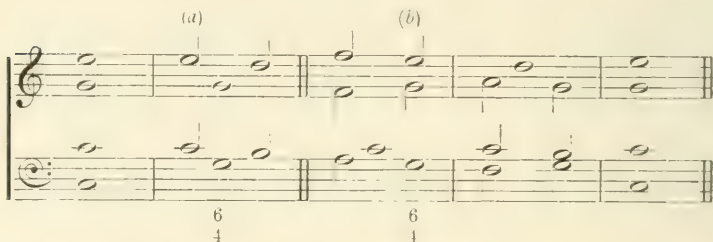
As for his theory of inversion, this is rightly regarded as one of his greatest achievements. Without such a theory, no intelligible system of harmony can be imagined. In what respect does Rameau's theory of inversion differ from that of Zarlino, if Zarlino's demonstration of the fact that each interval has its Octave complement may be described as a theory of inversion ? Is it not accomplished by the same means, namely, by means of the Octave ; by the similarity, the almost identity of effect existing between Octave sounds ? We find at the outset this very great difference, that Rameau considers some of the consonances to be original, or fundamental, and the others to be derived from them. For Zarlino, on the other hand, all the consonances are equally fundamental ; they are to be considered as arising successively from the *senario*, or as composed of its parts. Rameau's theory makes it impossible to consider a fundamental interval as other than it is ; it can never represent an inverted interval ; thus the Fifth can never be considered as an inverted Fourth. But Zarlino, if he regards the Fourth as the Octave complement of the Fifth, regards also the Fifth as the Octave complement of the Fourth. In the same way, he is unable to show why the major Third should not be considered as an inverted minor Sixth. Strictly speaking, Zarlino has no intervals which he can describe as inverted, for the reason that they are for him all equally " original " and " fundamental." While then Rameau considers, for example, the minor Sixth to have the same harmonic foundation as the major Third, to represent the inversion of this Third and, what is most important, to have the same harmonic meaning as this Third, Zarlino considers the minor Sixth to be an independent interval, explains its origin in a way altogether different from that of the major Third, and considers it to possess a quite different harmonic effect ; compared with the major Third it is much less consonant, almost resembling a dissonance.

With Zarlino, the inverted interval changes its meaning ; the reason for this being that it changes its fundamental note. Zarlino instinctively regards the lowest note as the basis and foundation of the harmony, even if he is unable

to explain why this should be so. While, therefore, in the case of the major Third, as $c-c$, he relates e to c ; in its inversion $c-c'$, he relates c' to e , and considers e to be the base or foundation of the harmony. In this he does quite rightly; the minor Sixth $e-c'$ retains its "original" effect only so long as the ear regards e as the fundamental note; if, on the other hand, it represents the major Third, and has the same harmonic meaning as this Third, the ear relates e to c as the fundamental and determining note of the harmony. But long before Rameau's time the minor Sixth, in addition to retaining its original meaning, had acquired a new one. Musicians perceived that the minor Sixth might produce on the ear much the same effect as the major Third. But although they perceived this, they were unable to account for it; and by their failure to recognize the cause of this change of effect they were led into all sorts of theoretical difficulties and contradictions. Rameau found the true explanation. In the minor Sixth $e-c'$ which is derived from the major Third $c-c$, not e but c must be regarded as the fundamental note, for the ear relates e to c , and not the reverse. The minor Sixth therefore must in this case be regarded, not as an original interval, but as derived from the major Third; and in the same way, the Fourth is derived from the Fifth. On the other hand, it is impossible to consider the major Third to be "derived" from the minor Sixth. The minor Sixth, in itself, is almost a dissonance, as Zarlino has shown; its inversion, the major Third, cannot represent this "original" character of the minor Sixth; nor can it have the same harmonic meaning. Similarly, the Fifth cannot be considered to be derived from the Fourth.

It is no accident that Rameau treats of *Harmonic Generation*, of the *Fundamental note*, and of the *Inversion of Chords*, at one and the same time. They are all connected in the closest possible way. In short, unless connected with some principle of harmonic generation, and of a harmonic fundamental or determining note, the inversion of intervals or of chords has no meaning for the science of harmony. This is a fact which has not always been duly appreciated by musicians and musical theorists. Nothing is more common than to find musicians who entirely reject acoustical phenomena as the basis of harmony. All, however, accept and utilize

Rameau's principle of harmonic inversion. The question therefore arises, have musicians sufficiently considered what this principle of harmonic inversion implies, and especially how it affects the whole question as to whether harmony has a physical basis? Inversion by means of the Octave does not in itself imply identity of harmonic significance; for unless they proceed from a common source and can be referred to a common fundamental note, "derived" or inverted intervals will retain, as they did for Zarlino, and must retain, their "original" character; all will be equally "fundamental," not only for the science of harmony, but also for the ear. As a familiar instance of the two-fold aspect which an interval or chord may assume, take the second inversion of the major or minor harmony, which long was a puzzle to theorists¹ :—



At (a) the $\frac{6}{4}$ chord is almost dissonant in effect; hence Heinichen gives it a place among the dissonant chords, its sounds *e* and *c* merely retard the Dominant harmony; the ear relates these sounds to *g* the Dominant, and not to *c* the Tonic; that is, the ear understands *g* as fundamental note. At (b), on the other hand, the chord has a different effect; in this case it has the same meaning as the Tonic chord, which it represents; here the ear understands *c* to be the fundamental.

From the foregoing it is comparatively easy to understand how the predecessors of Rameau so completely failed to make use of any knowledge they may have had of inverted intervals or chords for the simplification of their chord

¹ Rameau himself could not explain the dissonant effect of this chord. He considers it in one aspect only, namely, as representing the harmony of *c*. See remarks on this subject, p. 481.

tables. Within a few years of the appearance of the *Traité de l'harmonie*, however, Rameau's theory of the inversion of chords became universally accepted, and has been for long regarded as a commonplace of the theory of harmony. Rameau's predecessors attached the greatest importance to the interval, and were unable to distinguish between the bass note and the fundamental note of an interval or chord; the term fundamental being applied to the note which, for the time being, occupied the lowest position in the chord, no matter what this might be. Rameau, on the other hand, lays the greatest possible stress, not on the interval which an upper part forms with the bass, but on the fundamental note, and distinguishes carefully between fundamental and bass note. In thus relating the inversion of chords to his principles of Harmonic Generation and of the Fundamental Bass, Rameau firmly establishes the theory of Harmonic Inversion.

So far Rameau has done admirably. His treatment of the minor Third and the major Sixth, however, fails to convince. After saying that the only intervals directly generated from the fundamental sound are the Fifth and major Third, he tells us that the minor Third also must be considered to be generated directly, for it arises from the harmonic division of the Fifth. He then considers that the major Sixth is "derived" from the minor Third. But then might not the Fourth, in the same way, be considered to be generated directly by means of the harmonic division of the Octave? The major Sixth cannot be considered to be a "derived" interval until the minor Third has been proved to be fundamental. Unlike the Octave, Fifth, and major Third, the minor Third and major Sixth are not generated directly from the fundamental sound. They are not, in Hauptmann's language, "directly intelligible" intervals. Both intervals may retain their major as well as produce a minor effect, but they depend for their definition as constituents of the major harmony on a third sound, the fundamental note, which is nothing less than the *terzo suono* (combination tone) of Tartini. This third sound may not only be understood, but is actually present whenever either interval is sounded. In treating of the two intervals in question, Rameau does not push his researches far enough; but had he been acquainted with this phenomenon of the combination tones, he could hardly have failed to adduce it

as a striking confirmation of his theory. Rameau's anxiety to make the minor Third appear as a fundamental interval can be well understood. He requires it for the explanation of the minor harmony.

Further, Rameau is unable to explain why in the generation of the consonances by the first six numbers the next number, that is 7, should introduce, as he tells us, a dissonance. The reason alleged by Rameau, which he borrows from Descartes, namely, that the comparison of the consonances produced by the senary division gives the smallest intervals which the ear is capable of appreciating, is not adequate. Consonance is not determined by the extent to which the ear can appreciate minute differences of tone. Nor can the smaller intervals of tone actually used in music be said to be limited by those intervals which are recognized to be consonant. The Greeks recognized only the Perfect consonances, which could all be expressed by the first four numbers. Nevertheless they not only distinguished but made use of quarter tones, and were acquainted with such a small interval as the Pythagorean *limma* (243 : 256).¹ In modern music, also, smaller intervals than the chromatic semitone (24 : 25) are distinguished. Thus a species of quarter tone (125 : 128) arises from the enharmonic change.² It is quite evident however that in deciding that the number 7 introduces a dissonance, Rameau is influenced less by theoretical considerations than by the judgment of his ear. Yet even by allowing the ear to become the sole arbiter, the matter could not thus be placed beyond the range of controversy or of individual opinion.³ On the other

¹ Obtained by comparing the Fourth with two major tones, i.e., $\left[\frac{9}{8}\right]^2 \times \frac{3}{4} = 243 : 256$.

² As, for example, by enharmonically changing the augmented Fifth as $c-g\sharp$ ($\frac{2}{3} \times \frac{2}{3} = \frac{1}{2}\frac{4}{3}$) into the minor Sixth $c-a\flat$ (5 : 8). The difference between these intervals is $\frac{1}{2}\frac{4}{3} \times \frac{8}{5} = 1\frac{2}{5}$. The same quarter tone arises from the comparison of diminished Fourth ($g\sharp-c$) with major Third ($a\flat-c$).

³ Thus Mersenne, in his *Livre I. de la musique théorique*, with which Rameau was acquainted, is of opinion that there is no reason why the consonances should be limited by the number 6, and that the proportions 6 : 7, and 5 : 7 represent consonant intervals! Even Helmholtz (*Sensations of Tone*) cannot account for the exclusion of the number 7 on physical grounds. "As a matter of fact," he says, "the chords of the natural or sub-minor Seventh 4 : 7, or of the sub-minor Tenth 3 : 7, in many qualities of tone sound at least as

hand, Rameau might have maintained that it was time enough to treat of this "natural Seventh," and to give it a place in the musical system, when musicians actually begin to make use of it. This is by no means the most serious of the difficulties with which Rameau is soon to find himself confronted.

THE MINOR HARMONY.

Rameau's first great difficulty is to account for the Minor Harmony. He sees clearly that although the *senario* provides him with a major harmony it does not provide him with a minor one. He imagines that this difficulty can be overcome by proving that it is only in appearance and not in reality that the minor Third is generated indirectly from the fundamental sound. "From the union of the [major Third and Fifth," he says, "there immediately arises another interval, the minor Third. The Fifth, then, being composed of two Thirds, it suffices to determine the nature of the lower Third, in order to determine at the same time the nature of the upper Third (that is, if the lower Third is major, the upper Third must be minor, and *vice versa*, as *c-e-g*, *c-~~e~~^b-g*), for the interval of the Fifth remains the same, no matter whether the major Third is at the bottom or at the top." Rameau now considers that he is at liberty to place this minor Third either at the top, as in the major harmony, or at the bottom, as in the minor harmony. After all, he remarks, the only difference between these two harmonies lies "in the different disposition of the Thirds, which together make up the Fifth,"¹ for whether the minor Third occupies the lower or the higher position, "this makes no difference in the character of the Fifth, which has always a Third on one side or the other."² Such in brief is the explanation of the minor harmony given in the *Traité*.

well as the minor Sixth, 5 : 8, and the sub-minor Tenth *really sounds better than the minor Tenth 5 : 12.*" It is only "a circumstance of great importance for musical practice which gives the minor Sixth an advantage over the intervals formed with the number 7," namely, the fact that the minor Sixth is the inversion of the major Third. (*Sensations of Tone*, Part II., Ch. 12.)

¹ *Traité*, Book I., Ch. 8., Art. 2. ² *Traité*, Book I., Ch. 3., Art. 5.

Rameau however casts a longing glance at the inverted series of numbers, by which Zarlino explained the minor harmony. The minor Third, he says, must be considered to be generated directly from the fundamental sound; if not, "this Third could never alter its position, but must always take a middle place in chords (as $c\text{--}\widehat{c\text{--}g\text{--}c'}$), and never appear in the extremities (as $c\text{--}\widehat{c\text{--}b\text{--}g\text{--}c'}$); which would be contrary to the nature of the Arithmetical and Harmonic proportions, the first ($4 : 5 : 6$) dividing the Fifth into a major and a minor Third; the second ($6 : 5 : 4$) dividing the Fifth into a minor and a major Third."¹ But it is only for a moment that Rameau hesitates. In this inverted series he sees his fundamental principles, which he has discovered by the division, not the multiplication of a string, endangered. He thereupon devotes a long chapter to the discussion of this inverted proportion, in which he accuses Zarlino of having, by his use of it, obscured the principles of harmony and reversed the natural order of numbers, of intervals, and of the harmony resulting therefrom. He says:—"Zarlino has remarked that music is subordinate to arithmetic. But he forgets all this in his rules and demonstrations. By adopting the Harmonic descending proportion, he reverses not only the natural progression of numbers, but all the beautiful order of harmony which presents itself at once in the division of the string . . . for the numbers mark, in this case that is, the descending progression] the multiplication of the string, which is the sonorous body representing Unity, and not its division. In the descending progression 6, 5, 4, 3, 2, 1, the number 6 cannot represent Unity, nor serve as the source or foundation of the harmony. The foundation of harmony is therefore destroyed; it remains without a *basis*, or *bass*."

In short, Rameau, in the *Traité*, will have nothing to do with the descending progression. His fundamental sound,

¹ *Traité*, Book I., Ch. 3, Art. 5. Rameau here uses the terms Arithmetical and Harmonic in a sense contrary to that which is generally accepted, and to that which he himself adopts in his later works. As used by Rameau, the terms apply not to string-divisions, but to sound vibrations: only in this sense can the Arithmetical series 1, 2, 3, 4, 5, 6, represent the major harmony, and the Harmonic series, 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, the minor harmony.

which forms the foundation of the harmony; the Perfect Cadence, on whose importance he rightly lays so much stress: his Fundamental Bass;—all these form the very foundation of his system, and these he regards as the natural fruits of the ascending progression. But in rejecting the descending progression of numbers, he finds himself totally unable to give any rational account of the origin of the minor harmony.

ORIGIN OF THE THEORY OF CHORD GENERATION BY MEANS OF ADDED THIRDS.

But Rameau not only considers himself at liberty to place the minor Third, as well as the major Third, wherever it suits him; he imagines that he can *add* one Third to another. Thus he remarks:—"The Fifth and Thirds not only divide the principal chords, they also compose them, whether by their squares or by their addition."¹ Rameau now thinks that he has discovered a new and satisfactory way of accounting for the minor triad:—"Thus the addition of a major and a minor Third gives us the ratio 20 : 30 [that is 2 : 3 = perfect Fifth]. The difference between them is 24 : 25, and, according as we take the proportions 20 : 25 : 30 [= 4 : 5 : 6] or 20 : 24 : 30 [= 5 : 6 + 4 : 5], we obtain the major or the minor harmony. Likewise the *squares* of the major Third," he goes on to say, "and of the minor Third, give us respectively the augmented triad [as *c-e-g#*], and the diminished triad" [as *b-d-f*]².

Here we find the germ from which has been developed the theory of the generation of chords by adding Thirds together. But, it will be noticed, Rameau not only makes use of the *addition* of Thirds, but also of the *squaring* of Thirds and of other intervals, in order to explain the construction of chords. However extraordinary this latter process may appear to us, it may nevertheless be asked: If it is lawful to *add* intervals in order to generate chords, why is it absurd to *square* intervals in order to obtain a similar result? The one process is theoretically as good, or as bad, as the other. And why not also, while one is about it, make use of multiplication and subtraction? In

¹ *Traité*, Book I., Ch. 7.

² *Ibid.*

this respect at least Rameau is strictly logical. If he makes use of mathematics, he does so in a whole-hearted fashion and does not exclude either subtraction or multiplication. Here, for example, is one of his ways of generating the chord of the Submediant Seventh (major mode).¹

Minor Third	= 5 : 6
Fifth	= 2 : 3
<hr/>	
By multiplication	= 10 : 18
<hr/>	
By subtraction	= 12 : 15

Result : chord of Submediant Seventh = 10 : 12 : 15 : 18.

It is not only the Thirds which are manipulated in this way. For example, we are told that the square of the Fourth produces a Seventh ($\frac{3}{4}^2 = \frac{9}{16}$ = minor Seventh), and the square of the Fifth, a Ninth ($\frac{2}{3}^2 = \frac{4}{9}$ = major Ninth). It is only the addition of Thirds however which plays any essential part in the further development of Rameau's theory. On this point Rameau is quite definite. He says:—"In fact, to form the 'perfect' chord, it is only necessary to add one Third to another, and for dissonant chords it is necessary to add three or four Thirds to one another, the difference between these chords arising only from the different situation of the Thirds."²

Thus Rameau brings in a second and entirely new principle of harmonic generation. It is evident that he cannot successfully run both theories together side by side. Yet he attempts to do so, with the inevitable result that he falls into the grossest absurdities. His new principle of chord generation is introduced with the express object of proving that certain chords, including the minor triad, are in reality fundamental chords. Nevertheless, while he accepts the minor triad as a fundamental chord, he rejects the augmented and diminished triads. These, he tells us, are not fundamental chords.³ But how does Rameau discover this fact? According to his new theory of harmonic generation, these chords must be regarded as fundamental: for there is nothing in

¹ *Traité*, Book I., Ch. 7.

² *Ibid.*

³ *Ibid.*

this theory to indicate that a chord formed by the addition of two minor Thirds, as in the diminished triad, or two major Thirds, as in the augmented triad, is not equally fundamental with a chord formed by the addition of a major and a minor Third (as in the minor triad): especially as Rameau considers himself at liberty to add a major *or* a minor Third wherever he thinks the circumstances require it. Thus Rameau, having thrown his first principle of harmonic generation overboard, now finds himself compelled in turn to reject the consequences of his new principle. He is, in fact, in an extremely awkward predicament. Having brought forward a reason why chords generated by means of the addition of Thirds should be regarded as fundamental, he has now to discover a reason why such chords should be regarded as non-fundamental. He thinks this may be done by reverting to his original principle of chord generation (!) where not the Third, but the Fifth, is the first sound generated after the octave. The (perfect) Fifth, therefore, is proved to be more important than the Third; where then this Fifth does not dominate in a chord, such a chord is not fundamental: "its foundation is inverted, supposed or borrowed."¹

Rameau has now to determine what is the principal or primary constituent of harmony. Is it the Fifth: or is it the Third? According to his first principle of chord generation, it is the Fifth; according to his second principle, it is the Third. He requires the first principle in order to prove that certain chords generated by the second principle (the augmented and diminished triads, as well as certain chords of the Seventh) are non-fundamental; he requires the second principle because his first principle is not sufficient to determine the fundamental or non-fundamental nature of a chord. But the absurdity does not stop here: for Rameau sets out to prove that not only the Fifth, but *also* the Third, must be regarded as the primary constituent of harmony. He begins thus:—"The Fifth is the primary constituent in all chords."² In the same chapter he says: "In order to make matters more easily understood, we may for the present [!] consider the Thirds to be the sole constituents of all chords; in fact, in order to form the

¹ *Traité*, Book I., Ch. 7.

² "La Quinte est le premier objet de tous les accords." *Traité*, Book I., Ch. 3, Art. 5; Ch. 7, etc.

'perfect' [common] chord, it is only necessary to add one Third to another."¹ And again, "If we have considered the Fifth to be the primary constituent in all chords, we ought none the less to attribute this quality to the Thirds, of which it is composed."²

In short, the more Rameau endeavours to explain how it is that the Fifth, and at the same time the Third, should be regarded as the primary constituent of harmony, the more contradictory becomes his language, as might be expected; he cannot have it both ways. It is unfortunate for Rameau's principle of chord generation by the addition of Thirds, that if there is one thing more necessary than another for his theory of harmony, and especially his theory of the Fundamental Bass, it is that the Fifth should be considered to be more perfect than the Third, and to be the primary constituent of harmony. For this reason whenever Rameau is not immediately concerned with the generation of chords from added Thirds, he lays all possible stress on the greater perfection of the Fifth as compared with the Third. This is so, not only in the *Traité*, but also in his later works. In the *Démonstration du Principe de l'Harmonie* (1750), he remarks: "The difference between these two proportions [namely, those of the major and minor harmonies] consists of a transposition in the order of their Thirds, which produce in each case a Fifth; whence it is evident that the Fifth alone constitutes harmony, and that the Thirds vary it."³

Rameau's juggle with the Thirds, so that a major or a minor Third may now appear at the bottom, and again emerge at the top, does not constitute a "natural principle" of harmonic generation. It is a purely arbitrary process, and one which he is totally unable to justify.

¹ "Pour se rendre les choses plus familières, l'on peut regarder à present les Tierces comme l'unique objet de tous les accords; en effet, pour former l'accord parfait, il faut ajouter une tierce à l'autre." *Traité*, Book I., Ch. 7.

² "Si nous avons regardé la Quinte comme le premier objet de tous les accords, nous ne devons pas moins attribuer cette qualité aux Tierces, dont elle est composée." *Traité*, Book II., Ch. 5.

³ "La différence de ces deux proportions consiste dans une transposition d'ordre entre les deux Tierces, dont la succession forme de chaque côté la Quinte: d'où il est évident que la seule Quinte constitue l'harmonie, & que les Tierces la varient." *Démonst. du Principe de l'Harmonie*, p. 23.

CHORDS OF THE SEVENTH.

Thus far Rameau has treated of the major and minor harmonies. The Diminished and Augmented Triads, about which more is said later, he does not consider to be fundamental chords. His next task is to explain the origin or generation of the dissonant chords of the Seventh. In the *Traité* he has a plethora of means whereby chords of the Seventh may be generated, namely, by the multiplication, subtraction, addition and squaring of intervals. That which he most favours, and which he mainly adheres to in his later works, is the addition of Thirds. "If there are other chords besides the preceding," he says, "it is necessary that they should be formed from a major or a minor Triad, and one of its parts; that is, one of its Thirds. For example, the addition of a Third to a Fifth gives us the interval of the Seventh, and their subtraction will give us the complete chord. Thus the addition of Fifth and minor Third = 10 : 18, their difference is 12 : 15, and the complete chord has the proportions 10 : 12 : 15 : 18 (a). Proceeding in a similar way for the Fifth and major Third we obtain the proportions 8 : 10 : 12 : 15 (b)":

Chords of the seventh.

	(b)	(a)	(a)	(b)	(c)	(a)	(d)
Major mode.							
Minor mode.							

1. Most important of the chords of the Seventh is that on the Dominant. This chord is formed by adding a minor Third above the major triad. In general, it is better that the minor rather than the major Third should occupy the acute position in chords. "This arises from the natural order which has been at first prescribed for these Thirds, where we find the major Third at the bottom, whereas the acute position is occupied by the minor Third."¹ The chord of the Dominant

¹ *Traité*, Book I., Ch. 7.

Seventh is the most perfect of all the dissonant chords, although the diminished Fifth occupies a prominent place; this circumstance however seems to render still greater the perfection of the consonant chords which ought to follow it," namely, the Tonic triad, or its inversions.¹ The ratios of this chord are 20 : 25 : 30 : 36 ! (c).

2. A chord of the Seventh formed by adding a major Third above a major triad (8 : 10 : 12 : 15) (b), and another by adding a minor Third above a minor triad (10 : 12 : 15 : 18) (a). The first of these chords is accidental in its origin, and the Ninth is always understood; that is, it forms part of the chords "by Supposition," *c—e-g-b-d*, or *f—a-c-e-g*, where *e* and *a* are the real fundamental notes, and *c* and *f* the fundamental notes "by Supposition." (See p. 87.)

3. A chord of the Seventh formed by adding a minor Third below a minor triad, as *b-d-f-a*. "This chord differs from the chord of the Dominant Seventh in that the major Third, which in the latter chord was at the bottom, is here at the top [!]"² The addition of a minor Third below the minor triad is evidently in order to avoid making the diminished triad *b-d-f* the foundation of the chord. The ratios of this chord are 25 : 30 : 36 : 45 (d).

4. A chord of the Diminished Seventh, formed by adding a minor Third above the diminished Fifth divided harmonically (as *g#-b-d-f*). Such at least is Rameau's first explanation of the origin of this chord. The other chords of the Seventh are fundamental, for all are derived from the major or minor triad by means of a Third added above or below. But such is not the case with the chord of the Diminished Seventh, for this consists of three minor Thirds added together, so that the "perfect" chord is neither at the bottom (as in the chord of the Dominant Seventh) nor at the top (as in the chord of the Seventh on the Submediant of a major key). This leads Rameau to his second explanation of this chord. It must be understood as an *altered Dominant Seventh Chord*: "it is derived from the chord of the Dominant Seventh, by raising the fundamental note of this chord a semitone. In this shape the chord is said to be 'borrowed' (*emprunté*), because it borrows its perfection from a sound which does

¹ *Traité*, Book I., Ch. 8, Art. 3.

² *Ibid.*, Art. 6.

not appear in it.”¹ Thus the chord $f-g\sharp-b-d$ is borrowed from the Dominant Seventh chord $e-g\sharp-b-d$, by substituting f for e . Rameau insists that this is the original form of the chord: “It might appear that the chord should have the form, $g\sharp-b-d-f$; but as it is not $g\sharp$, but e which represents the fundamental note of the chord, the form $f-g\sharp-b-d$ is the correct one” (e).² (See *Example*, p. 85.)

Rameau, then, places a chord of the Seventh on each degree of the major scale, as well as on the minor scale, except the first and third degrees. The chords of the Seventh on these degrees, each of which contains the augmented triad, as ($a-c-e-g\sharp$; $c-e-g\sharp-b$) he does not consider to be fundamental chords. “In the chord of the augmented Fifth we can only understand a chord by Supposition, the lower sound being regarded as supernumerary.” All the chords of the Seventh treated of are comprised within the compass of the octave, and all give rise to three other derived chords, or inversions ($\begin{smallmatrix} 6 \\ 5 \end{smallmatrix}$, $\begin{smallmatrix} 4 \\ 3 \end{smallmatrix}$, and $\begin{smallmatrix} 4 \\ 2 \end{smallmatrix}$).

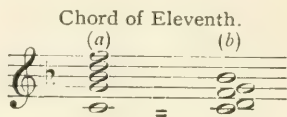
CHORDS BY “SUPPOSITION.”

Rameau has laid down the principle that no chord can exceed the compass of an Octave. The Octave, as Zarlino has said, “is the mother of all the intervals,” and all intervals larger than an Octave are merely repetitions of those contained within the Octave. Therefore a Ninth and an Eleventh are but the compound forms of a Second and a Fourth. Rameau however is aware that there are chords which do exceed the compass of an Octave; it is necessary to account for such chords. “We have seen,” he says, “that the foundation of harmony exists in the lowest sound of the ‘perfect’ chord; even if we have added a Third above this chord, in order to form the dissonant chord of the Seventh, still this does not contradict our principle; for this chord does not exceed the extent of an Octave, and it is divisible into Thirds. But if another Third be added, so as to form a chord of the Ninth, or still another Third, so as to form a chord of the Eleventh, everything becomes confused, and the basis of the harmony is

¹ *Traité*, Book I., Ch. 8, Art. 7.

² *Ibid.*

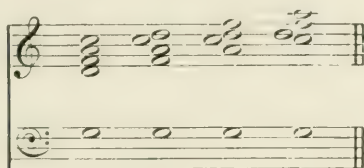
made obscure (a). The compass of the Octave is exceeded, and as the Ninth and Eleventh are merely the compound forms of the Second and Fourth, the chord is no longer divisible into Thirds (b) :



"If then a Fifth sound cannot be added *above* a chord of the Seventh, it must be added *below*. This added sound will *suppose* the fundamental sound, but the real fundamental sound will be immediately above it."¹ Thus in the chord of the Eleventh at (a) *g* is the real fundamental sound, while *c* is the "supposed" fundamental. In all "chords by Supposition,"² Rameau considers that the essential harmony is the chord of the Seventh. The sound which is added a Third or Fifth below is non-essential: it is merely "supernumerary." In the above chord, therefore, the essential harmony is the chord of the Seventh *g-b-d-f*; while *c* is the "supernumerary" sound. In the chord of the Ninth likewise, as *G-b-d-f-a*, the essential harmony is the chord of the Seventh *b-d-f-a*. In this chord Rameau evidently considers that *b* is the real fundamental sound, while *G* represents the "supposed" fundamental. In the chords by Supposition the chord of the Seventh lying immediately above the added sound is capable of the various inversions; the added sound itself, the fundamental by Supposition, cannot however participate in these inversions, but must always occupy the lowest position as a supernumerary sound, which does not alter the natural progressions of the notes of the chord of the Seventh lying immediately above it:—

¹ *Traité*, Book II., Ch. 10.

² The term *Supposition*, Rameau informs us, "has been used up to the present time to designate ornamental or grace notes, which form no essential part of the harmony or chord in which they occur; the term, however, ought more correctly to be applied to those sounds which alter the perfection of chords, in making them exceed the extent of an Octave." *Table of Terms*.



There are but two chords by Supposition, that of the Ninth, obtained by adding a Third below the chord of the Seventh; and that of the Eleventh, obtained by adding a Fifth below. The chords of the Ninth in most common use are the following :—

Chord of Ninth on Tonic of Major Key	:—C—c—g—b—d
„ „ „ „ Dominant „ „	:—G—b—d—f—a
„ „ „ „ Subdominant „ „	:—F—a—c—e—g
„ „ „ „ Mediant of Minor Key	:—C—c—g [#] —b—d
	(Chord of the superfluous Fifth)
„ „ „ „ Mediant of Minor Key	:—C—f—g [#] —b—d
	(Chord of the superfluous Second)

Of chords of the Eleventh there are :—

Chord of Eleventh on Tonic of Major Key	:—C—g—b—d—f
„ „ „ „ Dominant „ „	:—G—d—f—a—c
„ „ „ „ Supertonic „ „	:—D—a—c—e—g
„ „ „ „ Submediant „ „	:—A—e—g—b—d
„ „ „ „ Mediant „ „	:—E—b—d—f—a
„ „ „ „ Tonic of Minor „ „	:—A—c—g [#] —b—d
	(Chord of the Superfluous Seventh)
„ „ „ „ Tonic of Minor Key	:—A—f—g [#] —b—d
	(Chord of the superfluous Second)

The above, however, is not a complete list. “In practice,” says Rameau, “other chords of the Ninth and Eleventh are used.” Many of these chords of the Ninth and Eleventh sound harsh when all the notes are present,¹ consequently the Third or Fifth, or both Third and Fifth, of the chord of the Seventh

¹ *Traité*, Book III., Ch. 29, *et seq.*

(lying immediately above the fundamental note by supposition) must sometimes be omitted. For the same reason the Seventh should be omitted from the chord of the Ninth on the Tonic of the major key.

RESOLUTION OF DISSONANCES.

The Seventh is the source of all the dissonances, and the chord of the Seventh is the source of all dissonant chords. Of all the chords of the Seventh, that on the Dominant is the most important. It is by means of the resolution of the chord of the Dominant Seventh on the Tonic chord—its most natural resolution—that we discover the proper way in which to treat all dissonant chords. In this chord there are two dissonances which demand resolution: one, between the fundamental note and Seventh; the other, between the Third and Seventh. The first is a *minor dissonance*, and should fall one degree; the second is a *major dissonance*, and should ascend one degree. The former is the source of all the minor dissonances;

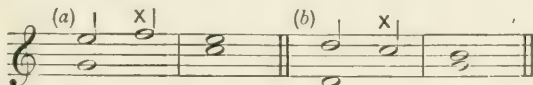


the latter of all the major dissonances. In reality, however, the Seventh is the origin of all dissonances, whether major or minor: for the (minor) Seventh which is added above the "perfect" chord (as *g-b-d-f*) forms a dissonance not only with the bass (*g-f*) but also with the third of the chord (*b-f*). The minor dissonance is so called because it is formed by the addition of a *minor* Third above the "perfect" chord; and the major dissonance because this is a *major* Third above the fundamental note.¹ The major dissonance is always the leading note of a key, the Third of the chord of the Dominant Seventh, and occurs only in this chord; in all other dissonant chords the dissonance is a minor one, namely, that of the Seventh, or its inversion, the Second.

¹ *Traité*, Book II., Ch. 18, Art. 1.

Up till now the greatest uncertainty and confusion have prevailed in respect of the proper treatment of dissonances. "Theorists tell us that the Seventh may be resolved on the 3rd, the 5th, the 6th, the 8th; that the diminished Fifth may be resolved on the 3rd, the 4th, the tritone, the 9th; thus science is made obscure; particular cases are cited, but no simple and intelligible rule has been formulated for the treatment of dissonances. If the Seventh may be resolved on different intervals, this arises only because of the different progressions of the bass"¹ (that is, because of inverted chords). In the resolution of the chord of the Dominant Seventh on the Tonic chord, however, "we find a sure and certain rule for the resolution of dissonances. . . . This rule permits of no exceptions, and proves that the fundamental harmony subsists only in the 'perfect' chord, and that of the Seventh."²

Further, the old rules concerning the syncopation of notes and the preparation of dissonances are merely a source of embarrassment: "Here are two simple rules which suffer no exception: I. To prepare by means of a consonance every dissonance which admits of preparation; and, II. to take [by step] after a consonance, whether by ascending (a), or by descending (b) that dissonance which cannot be prepared"³ :—



Thus the confusion which has prevailed in respect of the treatment of dissonances disappears; a confusion largely due to the fact that "*theorists have been accustomed to reckon dissonances from the bass upwards,*" whereby the dissonant nature of such chords as *c-e-g-a* or *a-c-d-f*, which consist entirely of consonant intervals above the bass, could not be determined.

By means of the natural resolution of the chord of the Dominant Seventh on the Tonic chord, we find the proper way in which to treat not only all other chords of the Seventh,

¹ *Traité*, Book II., Ch. 8.

² *Ibid.*, Ch. 18, Art 1.

³ *Ibid.*, Ch. 16, Art. 4.

but all chords by Supposition as well (chords of the Ninth and Eleventh). For in every chord by Supposition the essential harmony is that of the chord of the Seventh which is placed above the lowest sound of the chord (the "supposed" fundamental). This chord of the Seventh will be treated in the usual way, according to the rules prescribed for chords of the Seventh, and will be capable of all the different inversions; the sound added below, however, cannot be inverted, but will always occupy the lowest position; thus—



A striking example of the correctness of the theory of inverted chords,¹ is the fact that a dissonant chord and its inversions are all resolved in the same way; for example, the chord of the Dominant Seventh and its inversions are all resolved most naturally by the chord of the Tonic. It is clearly evident then, that the chord of the Seventh is the source of all the dissonant chords. Other writers have distinguished a great many varieties of dissonant chords, as chords of the Second, of the Tritone, and so forth; these however are not independent, but "derived" chords, which arise through inversion.² Note then, concludes Rameau, that there exist in harmonic music but two chords which are "original" and fundamental, namely, the "perfect" chord, and the chord of the Seventh.

¹ Rameau should add:—and of the manner in which inverted chords may retain the harmonic significance of the original and fundamental chord from which they are derived.

² *Traité*, Book II., Chs. 8. and 17.

Résumé OF RAMEAU'S THEORIES OF CHORD GENERATION.

Rameau's task in dealing with chords has been similar to that of the scientist who, finding himself confronted with a multitude of diversified and apparently unrelated phenomena, has to discover whether there may not be some hidden connection between them, whether indeed it may not be possible that even such a bewildering variety of species has had a common source in some simple and primitive *genus*. Of the innumerable chords which may be used in harmony, Rameau, by means of his theory of inversion, finds that there are but two, fundamental and original, from which all others are derived, namely the "perfect" chord (the major and minor harmonies) and the chord of the Seventh; and in place of the infinity of rules, exceptions from rule, etc., relating to the employment of these chords he brings forward one or two simple and comprehensive rules which are based on the natural resolution of the chord of the Dominant Seventh. Whether Rameau's explanation of the chord of the Seventh and of "chords by Supposition" be accepted or not, there is no doubt that his theory of inverted chords had already produced splendid results, representing an achievement for which he was fully deserving of the eulogies which were bestowed on him when once his theoretical principles were sufficiently understood. His fine ear and musical penetration, also, are apparent in his treatment of the augmented and diminished triads, which he refuses to consider as fundamental chords; and in his explanation of the chord of the diminished Seventh as being derived from the chord of the Dominant Seventh.

But no sooner has Rameau set out to establish his "natural principles" of harmony, than he finds himself plunged into difficulties and contradictions. He starts with a "natural principle" of harmonic generation which in itself is perfectly intelligible and consistent. It is from this principle, he tells us, that all chords derive their origin. But this principle has furnished him with *one* chord and one only, namely, the major harmony; neither the minor harmony, nor a single chord of all the dissonant chords which he considers to be fundamental, is to be found in the division of a string by the first six numbers. Rameau therefore finds himself compelled at the very outset to abandon the principle of

harmonic generation which he has at first proposed. The generation of chords by means of the addition of Thirds, which he brings forward in its place, is not a "natural principle" of harmony at all, but merely a device to get rid of a difficulty. He assumes that the "perfect" chord may be considered to be generated by the process of adding one Third to another, thus placing himself in contradiction with his original principle, whereby the first sound generated after the Octave is the Fifth (twelfth) and only afterwards the Third (seventeenth). But, says Rameau, does not the "perfect" (major) chord result from the harmonic division of the Fifth, whereby there arise two Thirds, one major, and the other minor? Rameau however cannot have it both ways. Even if he correctly explains the major harmony as arising from the harmonic division of the Fifth, he is still unable to show us how it can be regarded as resulting from the addition of Thirds, and still less to explain whence he derives the liberty of adding sounds to this harmony so as to form other chords.

In abandoning his original principle of harmonic generation, Rameau necessarily gives up at the same time his theories of the fundamental Bass, and of the inversion of chords. He leaves his chords without a harmonic foundation, without a Fundamental Bass. This is true even of the chord of the Dominant Seventh, which he recognizes to be the most important of all the dissonant chords. Rameau, of course, might have anticipated here the methods of some of his successors, and derived the chord by means of the number seven, applied to the division of the monochord. That he does not avail himself of this method as a possible means of escape from his difficulties is a proof of his perspicacity. If he admits it, he will destroy his whole system of harmony. But in rejecting it, he rejects at the same time the only possible means whereby the chord of the Dominant Seventh can be made to appear as fundamental, that is, in his own words, "generated from the first sound, which sound is consequently the principle and foundation" of all the other sounds of the harmony heard above it.¹

Having assumed that chords are formed by the addition of Thirds, he makes the further assumption that, in order to form the chord of the Seventh, he is at liberty not only to add

¹ Book I., Ch. 3, Art. 1.

either a major *or* a minor third to the "perfect" chord, but to place the added third either above or below. The results of this last process are somewhat peculiar; for example, in the chord of the Seventh on the leading note of a major key, as *b-d-f-a*, the note *b* cannot be regarded as the fundamental note of the chord, because not a perfect but a diminished Fifth is heard above it. This *b* must then be considered to be added *below* the minor harmony *d-f-a*; whereby *d*, the Third of the chord *b-d-f-a*, becomes its fundamental note.

Thus a new interval is formed, the Seventh, and in attempting to make this Seventh appear as fundamental, Rameau gives utterance to the most contradictory statements. He explains the Seventh as resulting from the square of the perfect Fourth. Not content with this—although the squaring of intervals is quite as justifiable as their addition—he argues that just as the harmonic division of the Fifth gives us two Thirds, each of which is fundamental, so the harmonic division of the major Third produces two Seconds, a major and a minor, from the inversion of either of which will arise the interval of the Seventh. "If fundamental chords, and if the fundamental progression of the bass consist solely of the intervals of the Third, Fifth and Seventh, then these intervals must also be regarded as fundamental. The best authors have proposed to us the Third and Fifth as the fundamental intervals (*pour principe*), but have always forgotten the Seventh, *which is the first of its species*. For does not this Seventh arise by inversion from the harmonic division of the major Third? Therefore it must be regarded as fundamental or excluded from the dissonances." ¹

Rameau has from the first maintained that there is only one dissonance, that of the Seventh; here he repeats this statement, and then almost in the same breath informs us that the Seventh is really an inverted Second, a contradiction which Mattheson was not slow to seize upon.² Again we

¹ *Traité*, Book II., Ch. 17, Art. 3.

² In his *Kleine General-bass Schule* Mattheson remarks:—"I must mention that in many places M. Rameau makes his beloved Seventh the origin of all the dissonances. But he also remarks that it arises from the addition of two Fourths, which however he soon contradicts, and asserts that the tone forms the Second, and from the inversion of this Second arises the Seventh. How then can it be the origin of all the dissonances, when it is itself derived from the Fourth, and is an inverted Second!"

read:—"If we are sometimes obliged to distinguish the dissonance by different names [Seventh, Second], this is only in order to facilitate practice; for at bottom there is only one dissonance, from which all the others are derived."¹ Finally, Rameau informs us that "the interval of the Seventh owes its origin more to good taste than to Nature, since it is not found in the most natural operations, as a part of the harmonic body, like the intervals which compose the 'perfect' chord."² This last statement is a confession of failure, and proves that Rameau was unable to satisfy even himself that his explanation of the origin of the chord of the Seventh was a reasonable one.

As for his theory of the generation of chords of the Ninth and the Eleventh (chords by Supposition) by adding a Third or Fifth below a chord of the Seventh so that each chord has two fundamental notes, a real and a "supposed" fundamental—little need be said. Rameau's procedure in respect of these chords is extremely ingenious, but of course purely arbitrary. It is singular that, although he treats the chords of the Ninth and Eleventh as fundamental chords, he is nevertheless quite well aware that they arise from the principle of the suspension or retardation of notes. Of the following example he remarks:—"It is certain that the chords by Supposition serve only to suspend the sounds that ought naturally to be heard: thus the sounds A suspend the sounds B"³:—

¹ *Supplement.*

² "Cet intervalle devant son origine au bon goût plus qu'à la nature, puisqu'il ne se trouve point dans les opérations les plus naturelles, faisant partie du corps Harmonique, de même que les autres intervalles qui composent l'accord parfait." (Book II., Ch. 17, Art. 1.)

³ Book III., Ch. 31.

It is singular also that after explaining the chord of the Diminished Seventh on the leading note of a minor key (as $g\sharp-b-d-f$) as an altered Dominant Seventh chord, Rameau should not have explained exactly in the same way the chord of the Seventh on the leading note of a major key (as $b-d-f-a$). Both chords are formed in an exactly similar way, although they do not consist of the same intervals. Of the chord of the Augmented Sixth, the different forms of which are already known to and mentioned by Heinichen, Rameau does not speak. His silence in respect of this chord can be understood.

Do Rameau's efforts, then, to explain the generation of chords represent merely so much time and labour wasted? Not altogether. They may instead lead to a positive result of the greatest importance for the science of harmony. Rameau, one of the greatest of theorists in the domain of harmony, is unable with all his ingenuity to discover any natural principle of harmony which will furnish him with more than one chord—the "perfect" chord. He is quite unable to justify in any way the theory of the generation of chords by means of the addition of Thirds. Finally, he is quite unable to explain chords of the Seventh, Ninth, and Eleventh as fundamental, that is, as consisting of sounds all of which are directly related to and arise from the lowest and fundamental sound of the chord. Rameau indeed demonstrates that the Second, which arises from the harmonic division of the major Third, has more right to be considered as fundamental than the Seventh. These are not merely negative results. It is a matter of the greatest consequence for the science of harmony if it can be proved—and Rameau's failures go far to prove it—that with the exception of the major harmony and that of the minor, to be further discussed, no others exist as a constituent and essential part of our modern tonal and harmonic system. It is not alone Rameau who has failed to discover them; the most strenuous endeavours of those who, even up to the present day, have sought to explain other chords as fundamental, in the sense given above, have met with no better success.

CHAPTER IV.

Rameau's *Traité de l'Harmonie* (contd.).

THE FUNDAMENTAL BASS.

STRICTLY speaking, the Fundamental Bass of Rameau is of more than one kind. There is the fundamental bass which is the direct result of his theory of the inversion of chords, and which has been in practical use in nearly every text-book of harmony since his time. This bass, which always represents the fundamental note of the harmony, is to be distinguished from the actual bass, the *basso continuo*, in which the bass note may have the Third, Fifth, etc., of the chord. But admirable and useful as this bass may be, the species of Fundamental Bass which Rameau evolves in Book II. of the *Traité de l'harmonie*, is even more important. By it Rameau endeavours to explain, on logical and scientific grounds, the laws which govern harmonic succession. A real science of harmony, Rameau perceives, must not be satisfied with the explanation of chords as isolated entities; it must also take into account harmonic succession: it must try to discover the underlying principles which govern the progressions from one harmony to another, and which render these intelligible.

It is the bass on which everything, as regards harmonic succession, depends; it is the bearer of the harmony, and its foundation; its progression therefore will determine the harmony which is to follow. Rameau lays stress on this point. He remarks: "Zarlino has compared the bass to the earth, which serves as a foundation for all

the other elements. It is called the *bass* of the harmony, because it is the *basis* and foundation of it. If the foundation were to fail, that would be as if the earth were to fail: all the beautiful order of Nature would fall into ruin; every piece of music would be filled with dissonance and confusion. When then one wishes to compose a bass, it is necessary to proceed by movements somewhat slow and separate. The higher parts may move more quickly and in diatonic [conjunct] progression."¹

This principle, Rameau says, cannot be too strongly insisted on, and it receives the greatest possible confirmation from the arithmetical division of a string, on which his theory is based. "The string with its divisions furnishes us with a perfect harmony, the bass of this harmony resulting from the entire string, which is the source and foundation of all the other sounds. If now we wish to determine the progression of the bass, it is evident that we ought to make it proceed by those consonant intervals given us by the first divisions of the string. Each sound therefore [that is, of this fundamental bass] will accord with that which has preceded it, and will bear a harmony like that which we have received from these first divisions. . . . It is the Fifth [the first sound generated after the Octave] which best suits the progression of the bass; in fact, one never hears a Final [Perfect] Cadence where this progression does not appear; the bass descending a Fifth, or, what is the same thing, ascending a Fourth. But as the Fifth is composed of two Thirds, the bass may proceed by this interval also [that is, by a Major *or* a minor Third] as well as by the interval of the Sixth, which is the inversion of the Third. All the progressions of the Fundamental Bass should therefore be comprised in these consonances. Sometimes, however, dissonance obliges us to make the bass ascend a tone or a semitone. But this can only occur by a licence, as in the Deceptive Cadence. It should be observed that this tone or semitone is the inversion of the Seventh."²

It is not essential, of course, that every bass note should at the same time be the fundamental note—the Fundamental Bass—of the harmony. Inversions may be made use of, where the bass note is the Third, Fifth, or Seventh of the

¹ *Traité*, Book II., Ch. I.

² *Ibid.*

chord, for by this means a great diversity of movement and harmony is obtained. Nevertheless, in such cases, the correct progression of the harmony can always be verified by comparing the Fundamental Bass with the actual bass (*basso continuo*) thus :—

The image shows two musical staves. The top staff is labeled "Continuo." and the bottom staff is labeled "Fundamental Bass." Both staves are in C major and 3/4 time. The Continuo staff has a treble clef and contains a series of chords: a triad of C-E-G, a dyad of E-G, a triad of G-B-D, a dyad of B-D, and a triad of D-F-A. The Fundamental Bass staff has a bass clef and contains a series of single notes: C, E, G, B, D. Below the Continuo staff, there are figures: 6, 4, 2, 6, 5, 4, 2, 6. Below the Fundamental Bass staff, there are figures: 7, 7, 7.

In thus determining the progression of the Fundamental Bass, we at the same time determine the progression of the upper parts, which for the most part, as Zarlino has said, should be diatonic : that is, these upper parts should proceed to the nearest harmony notes of the following chord. "Hence there will arise an agreeable succession of chords, without our being obliged to have recourse to any other rule, Nature herself being here our guide as to what is most appropriate and beautiful." ¹ The resolution of the chord of the Dominant Seventh on the Tonic chord shows clearly how the progression of the bass, which here descends a Fifth, determines the progression of the other notes of the harmony :—

The image shows two musical staves. The top staff is in treble clef and contains a series of chords: a triad of C-E-G, a dyad of E-G, a triad of G-B-D, a dyad of B-D, and a triad of D-F-A. The bottom staff is in bass clef and contains a series of single notes: C, E, G, B, D.

¹ *Traité*, Book II., Ch. 2.

the Fifth and the Octave resolve this dissonance (*b*) and (*c*):—

The musical notation consists of two systems. The first system has three measures labeled (a), (b), and (c). Measure (a) shows a dissonance resolving to a consonance. Measure (b) shows a dissonance resolving to a consonance with a 5th interval. Measure (c) shows a dissonance resolving to a consonance with an 8va interval. The second system has three measures labeled (d), (e), and (f). Measure (d) shows a dissonance that cannot be prepared or resolved. Measure (e) shows a dissonance that cannot be prepared or resolved. Measure (f) shows a dissonance that cannot be prepared or resolved. The notation includes treble and bass staves with various intervals and accidentals.

But according to the most natural progression of the harmony, the Third should be regarded as the only consonance which can serve as the resolution of dissonance (as at (*a*)). On the other hand, should the bass rise a Third, Fifth, or Seventh (or fall a Sixth, Fourth, or Second), the dissonance can neither be prepared nor resolved ((*d*), (*e*), (*f*)).¹

The fundamental progression of the bass, then, ought to be comprised in the intervals of the Third, Fifth, and Seventh: of which that by the Fifth is the best, then the Third, and lastly the Seventh. These same intervals which suit best the progression of the Fundamental Bass, ought also to accompany it: that is, each note of this Bass should bear the "perfect" chord, or the chord of the Seventh.² Such, in brief, is the Fundamental Bass, which Rameau explains at great length, and with much diffuseness and repetition, in the second as well as in the third and fourth books of the *Traité de l'harmonie* and which we have now to examine more closely.

¹ *Traité*, Book II., Chs. 13, 17, etc.

² *Ibid.*, Ch. 2.

In developing this part of his system, Rameau steps out with greater confidence, and does not betray the hesitation and uncertainty so conspicuously evident in the first book of the *Traité*, in which he has explained the generation of chords. He evidently regards his Fundamental Bass as a great achievement, as in some respects it undoubtedly is. He feels that he has grappled, not without success, with the two great central problems of harmonic science, namely, the generation of chords and the laws which govern their succession; that he has evolved a real science of harmony, and proved that all the bewildering variety of harmonic phenomena arises from a fundamental principle, the most simple and natural that one can imagine. With all the exultation of one who, after long combating and striving, has at length reached his goal, he exclaims: "How marvellously simple it all is! . . . The principle of harmony exists solely in the 'perfect' chord from which is formed the chord of the Seventh: more precisely in the fundamental sound of these two chords which is so to speak the Harmonic Centre (*Centre Harmonique*) to which all the other sounds are related.¹ . . . So that all this infinite diversity of harmony and melody, all these artistic ideas expressed with so much nobility and truth, proceed from two or three intervals disposed in Thirds, the principle of which is contained in a single sound, thus:—

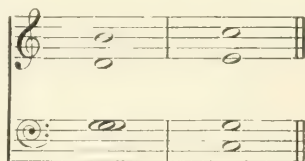
Fundamental	Third	Fifth	Seventh
I	3	5	7

One cannot grudge Rameau these few words of self-congratulation. Although he has failed to explain the generation of the various chords, he has nevertheless in other directions succeeded to a surprising extent. In the "natural principle" of harmony presented to him by Descartes there did not appear at first sight to be much which could suggest to him his theories of the fundamental note and the inversion of chords: certainly Descartes was far from deriving such consequences from his own principle. But who would have imagined that Rameau would seek in this

¹ Here Rameau uses the term "Harmonic Centre" not in the sense of a fundamental sound or *Tonic* which is the central sound of the key-system, but in the sense that each sound of the fundamental bass is itself a "Harmonic Centre"—*Traité*, Book II, Ch. 17.

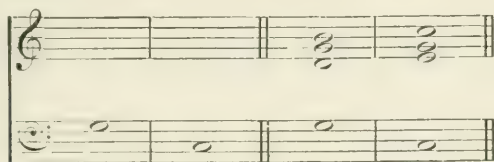
same principle of the mathematical division of a string for the origin and explanation of the laws which govern harmonic succession? That from such a division of a string there should arise the most "perfect" of all harmonies is in itself an astonishing fact; but that from such a harmony there should in turn arise the principles which determine the progression from one harmony to another, appears at first to be well-nigh incredible. Rameau has from the outset maintained that the whole principles of harmony have their origin in the division of a string by the first six numbers. If he succeeds in proving his theory of the Fundamental Bass, this will undoubtedly represent the highest achievement of his genius.

Rameau tells us that the most "perfect" progression of the Fundamental Bass is to descend a Fifth, as in the Perfect Cadence:—



Most musicians will agree that the most directly and easily intelligible of all harmonic successions is that from the Dominant to the Tonic harmony; it is in this sense, evidently, that Rameau makes use of the term "perfect progression." How then does he account for this? Because, he says, the Fifth is the first interval (that is, after the Octave) generated from the division of the string. The "perfection," then, of the fundamental progression in question would appear to be owing to the "perfection" of the consonance of the Fifth; this would explain also the comparative inferiority of the fundamental progression by the Third, which is generated after the Fifth. But this is not a sufficient explanation. "Perfection" of consonance and "perfection" of the fundamental progression of the bass do not necessarily mean the same thing, and we are not entitled to infer that the "perfection" of the one arises from the "perfection" of the other. Let it be granted, however, that Rameau fully understands what he nevertheless fails to communicate to us, namely, that the "perfection" of the descending progression by the Fifth, as in the Perfect Cadence, is due

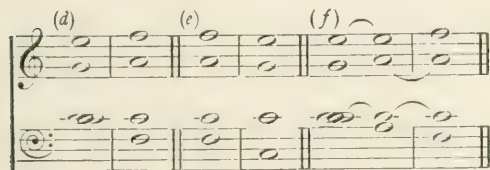
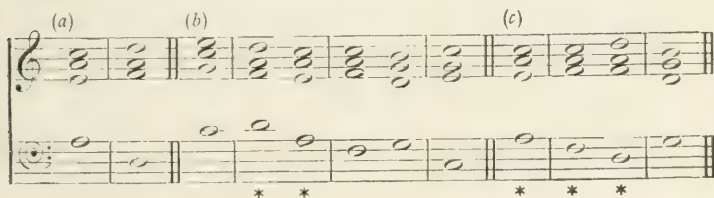
to the directness and closeness of relationship existing between the two sounds which constitute this Fifth. The lower sound of this Fifth is understood as the fundamental sound ; the higher sound is a dependent sound, which has its meaning as Fifth determined by the fundamental sound in which it has its origin. Such a closeness of relationship existing between the two sounds of Fifth and Fundamental, it follows that the same closeness of relationship will exist between their harmonies : —



Fifth. Fundamental.

Something of this appears to have been in Rameau's mind, for he makes the noteworthy statement that "in the Perfect Cadence the Fifth returns, as it were, to its source."¹

But even if we accept the above as an adequate and complete explanation of a Dominant-Tonic harmonic succession, as in the Perfect or Authentic Cadence, or of a Tonic-Dominant succession, as in the Imperfect Cadence or Half-Close, what of the other cases in which the Fundamental Bass descends a Fifth?—



¹ *Traité*, Book II., Ch. 18.

Rameau seems to imagine that these admit of an explanation similar to that of the Perfect Cadence.¹ Would then Rameau say of examples (a) and (d) that here the Fifth returns to its source? If so, and if these harmonic successions are to be explained in the same way as the Perfect Cadence, how then do they differ so greatly from it in effect? Rameau's explanation does not suffice. Further, the *ascending* Fifth progression of the bass at (b) and (e) cannot be considered to be inferior to the *descending* progression at (a) and (d). Nor, finally, can the progression of the Fundamental Bass by Thirds (c), be considered to be inferior to the descending Fifth progression at (a). Moritz Hauptmann considers it to be greatly superior. For Hauptmann, "the succession of two triads is intelligible only in so far as both can be referred to a common element which changes meaning during the passage."² This "common element" consists in the community of sounds existing between the two triads. The harmonic succession at (d) is, according to Hauptmann, intelligible by virtue of the common note c, but is rendered more directly intelligible by means of the mediating triad *a-c-c*, as at (f), between which and the triads *c-e-g*, and *f-a-c*, there are found *two* notes in common. Hauptmann therefore plainly considers the Fundamental Bass in Thirds to be more "perfect" than that in Fifths.

The position here taken up by Hauptmann (chord-relationship by community of sounds) does not differ essentially from that of Helmholtz, in his *Sensations of Tone* (chord-relationship by community and relationship of upper partial tones); but although the latter follows the former in his conclusions as respects chord-relationship, he is much less consistent. Helmholtz, in fact, thinks with Hauptmann that those chords are most closely related which have most notes in common; and also with Rameau that the closest relationship existing between any two sounds is that between a note and its Fifth! He says expressly:—"When two chords have two notes in common they are more closely related than when they have only one note in common. Thus *c-e-g* and *a-c-e* are more closely related than *c-e-g* and *g-b-d*."³ In the same chapter however he makes the

¹ *Traité*, Book II., Ch. 18.

² *Harmony and Metre*.

³ *Sensations of Tone*, Part III., Ch. 15.

following pronouncement with regard to the Fundamental Bass rising, as well as falling, a Fifth: "The closest and simplest relation of the tones is reached in the major mode, when all the tones of a melody are treated as constituents of the compound tone of the Tonic, or of the Fifth above or the Fifth below it. By this means all the relations of tones are reduced to the simplest and closest relation existing in any musical system—that of the Fifth." Helmholtz apparently prefers to have it both ways. "The chord of the Tonic C," he proceeds, "is somewhat differently related to the chord of G, the Fifth above it, and to the chord of F, the Fifth below it. When we pass from C-E-G to G-B-d, we use a compound tone G, which is already contained in the first chord, and is consequently properly introduced, while at the same time such a step leads us to those degrees of the scale which are most distant from the Tonic, and have only an indirect relationship with it. Hence this passage forms a distinct progress in the harmony, *which is at once well assured and properly based*. It is quite different with the passage from C-E-G, to F-A-c. The compound tone F is not prepared in the first chord, and it has therefore to be discovered and struck. The justification of this passage, then, is not complete on the ground of close relationship between the chords, until it is felt that the chord of F contains no tones which are not closely related to the Tonic C. Hence, in this passage from the chord of C to that of F, *we miss that distinct and well-assured progression* which marked the passage from the chord of C to that of G. But as a compensation, the progression from the chord of c to that of F has a softer and calmer kind of beauty, due perhaps to its keeping within tones directly related to the Tonic C."¹

Let it be observed that Helmholtz is here explaining the chord successions by virtue of the upper partial tone relationship existing between the harmonies; that the first succession is that of the Fundamental Bass rising a Fifth, and the second that of the Fundamental Bass falling a Fifth. Helmholtz considers that the first chord succession, in which the bass rises a Fifth, is more "distinct and well assured" than the second, in which the bass falls a Fifth. But in this latter case we have exactly the same succession of harmonies as

¹ *Sensations of Tone*, Part III., Ch. 15.

in the Perfect Cadence. If Helmholtz refuses to consider that the progression from the Dominant harmony $g-b-d$ to the Tonic harmony $c-e-g$ is to be explained in the same way as the progression $c-e-g$ to $f-a-c$, then he is unable to find any explanation whatever of the progression from the Dominant to the Tonic harmony. As matters stand Helmholtz says in effect that of the two Cadences, the Perfect, in which the Fundamental Bass falls a Fifth, and Imperfect (Half-Close) in which it rises a Fifth, the second is in reality the more perfect, for we find in it that "distinct and well-assured progression" which we miss in the former. This is a conclusion exactly the opposite of that arrived at by Rameau; it is also one which no musician will entertain for a moment.

Further, in the passage which follows the above, Helmholtz thus treats of the Plagal Cadence, of the Subdominant-Tonic harmonic succession, in which the Fundamental Bass rises a Fifth. "The Plagal Cadence," he says, "corresponds to a much quieter return of the music to the Tonic chord, and the progression is *much less distinct than before*."¹ Here Helmholtz completely reverses his former statement regarding the harmonic progression in which the Fundamental Bass rises a Fifth. There the progression to the Fifth above was a "distinct and well assured" progression; here the progression produces quite a different effect. In the first instance, it was the bass descending a Fifth which gave to the harmonic succession "a softer and calmer kind of beauty"; it is now the opposite progression of the bass rising a Fifth which produces this effect. To be sure the æsthetical impressions made upon us by these harmonic successions are as Helmholtz describes them; but Helmholtz makes it quite evident that it is not by means of his theory of chord relationship that such harmonic successions are to be explained.

On the other hand, it is equally evident that Rameau has not sufficient grounds for asserting that the most "perfect" progression of the Fundamental Bass is to descend a Fifth. It is contrary to the facts; while it is true of the Perfect Cadence it is not true in the case of many other harmonic successions. In certain cases the descending Fifth progression

¹ *Sensations of Tone*, Part III., Ch. 15.

is even inferior to the ascending Fifth progression, as well as to the progression by the Third. It is to be noticed that in allowing the Fundamental Bass to ascend as well as descend, by the intervals of the Third, Fifth, and Seventh, or their inversions, Rameau accords to it the liberty to fall by any interval, large or small, to be found in the diatonic scale. It may proceed by means of a semitone, tone, minor or major Third, perfect Fourth or Fifth, major or minor Sixth, major or minor Seventh, perfect Octave—an extremely satisfactory arrangement, no doubt, for by this means the Fundamental Bass is made to fit in with every conceivable harmonic progression in the diatonic scale. Where has Rameau discovered these intervals, and whence does he think he has derived the liberty of making use of them for the progressions of his Fundamental Bass? From the division of a string by the first six numbers? So he apparently imagines.

Rameau, in fact, proceeds here almost exactly in the same way as he has already done in the case of the generation of chords. He brought forward the *scenario* as the true principle of Harmonic Generation, and no sooner had he done so than he abandoned it in favour of a process of chord formation by means of added Thirds. He now brings forward this same *scenario* as the true principle of harmonic succession, and immediately abandons it in favour of a theory whereby the Fundamental Bass is allowed to progress by intervals, or tone relations, which are not found in the *scenario* at all. In the *Traité de l'harmonie* Rameau does not understand his own theory of the Fundamental Bass. He quite loses sight of the fact that the actual sounds which arise from the arithmetical division of a string are these, and these only :—

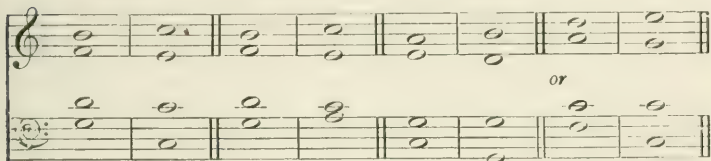


(in this case C, the lowest sound, represents the sound produced by the entire length of string). Excluding the octave

THE CADENCE.

The progression of all dissonant chords, whether these are inverted chords, chords by "Supposition," or "borrowed" chords, is comprised in three Cadences, which are the Perfect, the Interrupted, and the Irregular Cadences :—

Perfect. Interrupted. Irregular.



In the Cadence the penultimate chord should be dissonant ; this dissonant chord will render the consonant effect of the final chord still greater, and accentuate the impression of repose.

Thus in the *Perfect Cadence*, in which the Fundamental Bass proceeds from Dominant to Tonic, "it appears natural that the penultimate chord should be distinguished by something which renders it less perfect ; for if two perfect chords follow one another in a Perfect Cadence, one is unable to judge which of these chords is the true chord of repose."¹

The Interrupted or Deceptive Cadence.—"If we alter the progression of one of the sounds of the first chord which forms part of the Perfect Cadence, this change of progression will interrupt the conclusion ; hence the term Interrupted Cadence (*Cadence Rompue*). In this Cadence the Fundamental Bass, instead of descending a perfect Fifth from Dominant to Tonic, will ascend diatonically one degree, namely, to the sixth degree of the scale. With the exception of the progression of the bass, this cadence differs in nothing from the Perfect Cadence ; the other notes of the chord of the Dominant Seventh have the same progression as formerly. It should be remarked that it is better to double the Third, rather than the fundamental note, in the chord on the sixth degree of the scale, because this third '*supposes*,' or takes the place of the true fundamental sound."² . . . The progression of the bass in the Interrupted Cadence is due

¹ *Traité*, Book II., Ch. 2.

² *Ibid.*, Ch. 6

to a licence. A dissonance can be resolved only by the Fundamental Bass descending a Fifth; if then the bass descends a Seventh or, which is the same thing, rises a Second, it is only by means of a licence that this can be effected. For this interval of the Seventh owes its origin more to good taste than to nature, since it is not found among the sounds arising from the division of a string; it is this interval of the Seventh which gives rise to such a licence," and, consequently, to the Interrupted Cadence.¹

The Irregular Cadence.—In the Perfect Cadence the progression is from Dominant to Tonic; in the Irregular Cadence it is from Tonic to Dominant. As in the other two cadences, the first chord will be dissonant; but the dissonance in the Irregular Cadence consists, not in the Seventh added to the "perfect" chord, but in the Sixth added (chord of the "*Added Sixth*"). This Sixth, it is true, is consonant with the bass, but it forms a dissonance with the Fifth of the chord. Unlike the Seventh, it resolves upwards; it has therefore an *irregular* resolution. But, in common with the Seventh, it resolves on the Third of the following chord. The Irregular Cadence frequently occurs also in the progression from Subdominant to Tonic.² The Subdominant should, in fact, naturally bear the chord of the Fifth and Sixth ($\frac{6}{5}$).³

But, Rameau proceeds, "the Sixth added to the first chord in this cadence is a supernumerary sound, sanctioned only by good taste" [!]. It does not, therefore, determine the progression of the bass. The chord which it forms is not a fundamental chord; that is, it cannot be regarded as being derived from a chord of the Seventh (first inversion of the Supertonic Seventh), because its resolution is different.⁴ Nevertheless, in the Supplement to the *Traité*, Rameau is of opinion that the chord of the Added Sixth must actually be regarded as a fundamental and original chord, although he cannot well reconcile this with his former statement that all fundamental chords consist of a series of Thirds. In short, Rameau contends that if the chord of $\frac{6}{5}$ on the Subdominant resolves on the Dominant harmony, it

¹ *Traité*, Book II., Ch. 6.

² In all his subsequent works, Rameau treats the chord of the "*Added Sixth*" exclusively as a Subdominant discord.

³ *Traité*, Book II., Ch. 7. ⁴ *Ibid.*, Ch. 17, Art. 3.

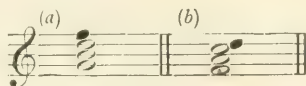
is the chord of the "*grande Sixte*," the first inversion of the chord of the Seventh on the Supertonic; if, on the other hand, it resolves on the Tonic harmony, as in the "irregular" cadence, it is the chord of the "*Added Sixth*," an original chord, and not derived from any other chord. In the first case the dissonant note is the *Fifth* (the Seventh of the fundamental chord); in the second case the dissonant note is the *Sixth*, and the fundamental note of the chord is in the bass. Thus in the chord of the "*grande Sixte*" *f-a-c-d* (the first inversion of the chord of the Seventh *d-f-a-c*), the dissonant note is *c*, and the fundamental note *d*; but in the chord of the "*Added Sixth*" *f-a-c d*, the dissonant note is *d*, and the fundamental note *f*. Rameau's theory of the chord of the "*Added Sixth*" has fared rather badly at the hands of some of his successors, who have described as the chord of the "*Added Sixth*" what Rameau expressly stated was not such. Even in our own day there are theorists who have explained the chord *f-a-c-d*, as a "*Dominant Discord*," as the inversion of the chord *d-f-a-c*, but who nevertheless have given to it the name of the chord of the "*Added Sixth*." Rameau, on the contrary, insists that the chord of the "*Added Sixth*" consists of a major Sixth added above the Subdominant harmony; that it is a Subdominant, not a Dominant discord. Unless this view as to the origin of the chord of the "*Added Sixth*" be accepted, it is obviously incorrect to describe it as such: the name becomes altogether meaningless.

The theoretical importance of this chord, and the remarkable theoretical acumen evinced by Rameau in dealing with it, will soon be commented upon: in the meantime, only a passing notice need be taken of the gross contradictions in which Rameau finds himself involved in his attempts to explain the chord of the "*Added Sixth*" as original and fundamental. He has maintained that there is but one dissonance, that of the Seventh, and that the Second is derived from the Seventh by inversion: he now concludes that the Seventh and the Second are really the same: "they are all one; the dissonance arises from the division of the major Third."¹

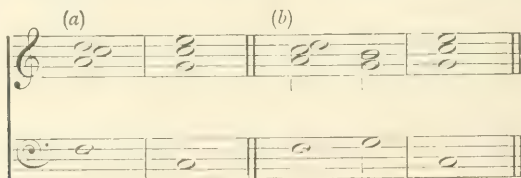
He is now satisfied that he has accounted for the two

¹ Supplement to *Traité*.

most characteristic discords of the key-system. One is a Dominant discord (*a*), and is obtained by adding a Seventh above the Dominant harmony; the other is a Subdominant discord (*b*), and is obtained by adding a Sixth above the Subdominant harmony:—



Rameau's principal object, however, in adding a Sixth above the Subdominant chord is to give to this chord a determined progression, to make its resolution on the Tonic chord an absolute necessity. But he has himself informed us that this chord may present a two-fold aspect; it may be considered not only as a chord of the "*added Sixth*," but as the first inversion of the chord of the Seventh on the Supertonic. In reality, the effect of this added Sixth is to accentuate the tendency of the Subdominant harmony, not towards the harmony of the Tonic, but towards that of the Dominant. Of the two resolutions of the chord *f-a-c-d* at (*a*) and (*b*), of which the first is Rameau's example of the "*Irregular Cadence*," it cannot be said that the second is any less "*natural*" than the first; on the contrary, the second may be regarded as the more "*natural*" resolution. Thus Rameau, instead of giving to this chord a determined progression, only succeeds in defeating his own object:—



It is by means of the three Cadences that the treatment of all dissonant chords is determined. Rameau indeed is of opinion that all harmony is nothing else than a succession of cadences.¹ The cadences, then, prove afresh "that there

¹ *Traité*, Book III., Ch. 27.

are but two chords which are essential and fundamental, namely, the Perfect chord and the chord of the Seventh; and that all the rules of harmony are based on the progressions natural to these two chords."¹ It is "from the Perfect Cadence that the principal and fundamental rules of harmony are derived."

Further, it is by means of the Cadence that the *key* is determined. The Irregular as well as the Perfect Cadence may serve to determine the key. In this respect however the Irregular Cadence is less definite than the Perfect. Indeed it is only when the major and minor dissonances are heard together and resolved as in the Perfect Cadence that the key can be said to be properly fixed.² In the Perfect Cadence we find all the notes of the scale except the "sixth note" (submediant); this sixth note however appears in the Irregular Cadence.³

Again, it is by means of the Perfect Cadence that we are able to modulate into other keys. "We cannot proceed naturally from one key to another *except by a consonant interval*, so that, after beginning a piece in a certain key, we may modulate into another that is a 3rd, 4th, 5th or 6th above or below" the original key-note or Tonic.⁴ In other words, Rameau considers that those keys are related whose tonics are consonant with each other. He is of opinion that, for example, the keys of E major with four sharps, and A \flat major with four flats, are more closely connected with the key of C major than is D major, which has only two sharps, or B \flat major which has only two flats in the key-signature. In this question of key-relationship Rameau proves himself to be far in advance of his time. Few, if any, of his contemporaries were of opinion that the keys of E and A \flat major were closely related to C major. Even a whole century later, such views were by no means prevalent among orthodox theorists. Hence, when Beethoven introduced in some of his works in Sonata form the second subject in the key of the mediant major,⁵ theorists were considerably embarrassed in order to account for

¹ *Traité*, Book II, Ch. 5.

² *Ibid.*, Book III., Ch. 14.

³ *Ibid.*, Book II., Ch. 21.

⁴ *Ibid.*, Book III., Ch. 23.

⁵ See, for example, the first movement of his Pianoforte Sonata in C major Op. 53 (the *Waldstein*).

such an innovation. It is only since Beethoven's time that the old rules applying to the relationship of keys have been found to be inadequate. The teaching of our present-day theorists, namely, that those keys are related whose tonics are consonant with each other, has in fact been necessitated by the practice of the great composers. But it is a noteworthy fact that these views were first enunciated by Rameau, who had no such advantages of experience, but who based his conclusions mainly on theoretical grounds, at the beginning of the eighteenth century.

NATURE AND FUNCTIONS OF CHORDS: DETERMINATION OF "KEY": NECESSITY FOR DISSONANCE IN MUSIC.

In the course of the second, third, and fourth books of the *Traité*, and especially in treating of the use of the Fundamental Bass in composition, Rameau throws out a number of observations respecting the nature and functions of chords, which raise questions of the utmost importance for the theory of harmony. Rameau is of opinion that composition by means of the Fundamental Bass is an easy matter. "We might speak," he says, "of the experience of several persons, who, by means of the fundamental bass, and after reading through our rules once or twice, have composed a harmony as perfect as one could wish." He lays down a principle which has since been almost universally followed in text-books of harmony, namely that the learner should from the outset write his exercises in four-part harmony, for it is only in this way that harmony can be properly taught. "Zarlino has said on the subject of four-part harmony that it can scarcely be taught on paper, and that he leaves it to the discretion of composers, who should be guided by the rules given for composition in two or three parts. On the contrary, harmony can be properly taught only in four parts, in which all particulars are comprised in two chords; it is then easy to reduce these four parts to three or two parts."¹

¹ *Traité*, Book II., Ch. 10. Here again it is evident that Rameau was little aware of the change which the art of music had undergone since the time of Zarlino. It is surprising that Rameau, good contrapuntist

As to the kind of harmony which ought to be assigned to each note of the Fundamental Bass, that is, the species of chord proper to each degree of the scale, Rameau directs that the "perfect" chord should be placed only on the Tonic. He states further that every note which bears the "perfect" chord must be regarded as a Tonic.¹ The reason for this is that "the consonant progression of a fundamental bass, above which only 'perfect' [therefore consonant] chords are heard, presents to us as many different keys as there are sounds in this bass. . . . It is certain that every sound above which the 'perfect' chord is heard conveys to the mind the impression of its key."² Rameau however finds himself obliged to modify, and indeed to contradict this statement, and to admit that other degrees of the scale besides the Tonic may bear the "perfect" chord. He first concedes that this chord may appear on the Dominant,³ and afterwards allows the same liberty to the Subdominant. "The 'perfect' chord may be given only to the key-note, its Fifth, and its Fourth."⁴ A little later he makes a statement in which he appears to include other notes of the scale besides the three already mentioned. "The 'perfect' chord," he says, "may be taken in a diatonic progression of the bass" (as for example in the Deceptive or Interrupted Cadence). It is in fact impossible to discover precisely on which degrees of the scale Rameau considered that the "perfect" chord should be placed. If he says expressly in one place that the harmony should be that of the "perfect" chord, he says no less positively in another place that the chord of the Seventh should be taken. But it is not difficult to understand the reasons for his perplexity.

though he was, did not perceive that Zarlino's rules applied to counterpoint, not harmony, in the modern sense of the term, and that he did not distinguish between the two forms of composition. As Rameau maintained that melody has its origin in harmony, we must infer that he also considered harmony to be the basis of counterpoint, and that an acquaintance with the rules of harmony, as well as a certain degree of facility in harmonic composition, should precede the study of counterpoint.

¹ *Traité*, Book III., Chs. 23 and 26; Book IV., Ch. 7, etc.

² *Ibid.*, Book II., Ch. 22.

³ *Ibid.*, Book II., Ch. 21.

⁴ *Ibid.*, Book III., Ch. 18.

His version of the "rule of the octave" is as follows:—

The Tonic takes the "perfect" chord.

The second degree¹—the second inversion of the Dominant Seventh chord.

The Mediant —the first inversion of the Tonic chord: "the Mediant always represents the principal note—the Tonic."

The Fourth degree¹—the chord of the "grande sixte" ($\frac{6}{5}$) when it rises a degree; and the last inversion of the Dominant Seventh chord when it falls a degree.

The Dominant —the "perfect" chord: or the chord of the Dominant Seventh.

The Sixth degree¹ —the chord of the sixth, in rising a degree; and the chord of $\frac{3}{2}$ ("petite sixte") in falling a degree.

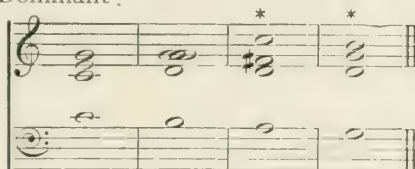
The Leading note ("note sensitive")—the first inversion of the Dominant Seventh Chord in rising a degree: and the chord of the sixth in falling a degree.

That is:—

The musical notation consists of two systems, each with a treble and bass staff. The first system (top) shows a sequence of chords: C major (4/3), D minor (6), E minor (6/5), F major (6), and G major (6/5). The second system (bottom) shows: A major (6), B minor (4/3), C major (4/2), D minor (6), and E minor (4/3). The figures are placed below the bass staff of each system.

¹ These are the terms employed by Rameau in the *Traité*.

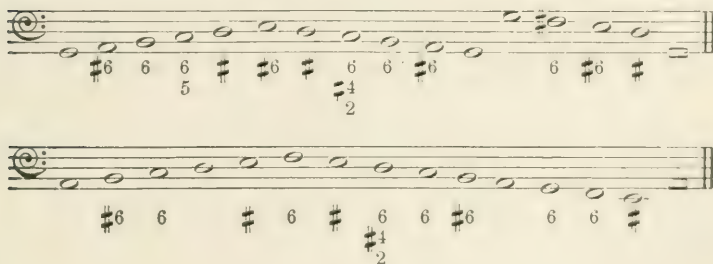
Rameau however apparently considered the harmony he assigns to the descending sixth degree to be stiff and unnatural in its effect, for later (Book III., Ch. 11) he changes $F\sharp$ to $F\sharp$ so that the harmony of this section of the scale appears in the key of the Dominant:—



This alteration he also made use of in his later works. It will be observed that he permits the "perfect" chord to appear not only on the Tonic but on the Dominant as well. He does not make mention of the circumstance which, according to some theorists, gave to the "rule of the octave," as practised not only in France, but also in Italy, Germany, and England at the latter part of the seventeenth and beginning of the eighteenth centuries¹ its real import for the science of harmony; the circumstance, namely, that all the harmonies comprised in it consist either of those of the Tonic, Dominant, and Subdominant, or may be considered to be derived from these three. The awkward necessity of being obliged to borrow, from the Dominant key, a harmony appropriate for the descending sixth degree

¹ The versions of the "rule of the octave" given by Gasparini (*L'armonico pratico al cimbalo*)—which was indeed that constantly in use in the Italian school of violinists of which Corelli was chief,—and by Mattheson (*Kleine Generalbass Schule*) are substantially the same as that of Rameau.

GASPARINI.



may have proved a difficulty.¹ But it was in his *Nouveau Système de Musique Théorique* that Rameau first grasped the theoretical significance of the Subdominant, and gave this name to the fourth degree of the scale.

To the important chord of the Dominant Seventh Rameau gives the name of "*Dominant-Tonic*," seeing that this chord is most naturally followed by that of the Tonic. To the other chords of the Seventh he gives the name of "*Dominants*," as they require for their resolution that the Fundamental Bass should descend a Fifth, as in the Dominant-Tonic chord. As now in composition we ought to prefer those progressions of the Fundamental Bass which are most perfect, that is,

MATHESON.

Figured bass for the first line (G major): 6, 6, 6, 6, 6, 6, 4, 6, 6.

Figured bass for the second line (C major): #6, 6, 6, #, 6, 6, 6, 4, #, 4, 6, #6.

Keller (*Rules for playing a thorough bass*) gives the ascending form of the major scale thus:—

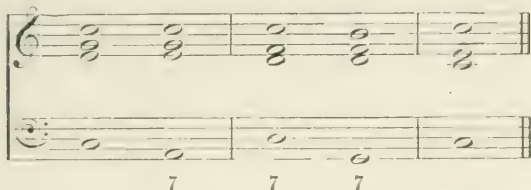
Figured bass for Keller's ascending scale: 6, 6, 6, 6, 5.

In the descending form of the scale, he prefers like Mattheson, Gasparini, and Rameau, to make a modulation to the Dominant key:—

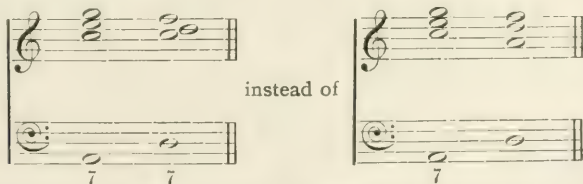
Figured bass for the descending scale modulation: 6, #6.

¹ In his later works, Rameau's difficulties in connection with the logical and systematic harmonization of this section of the scale increased rather than diminished, and gave rise to his well-known doctrine of the "double employment of dissonance."

those which proceed by the interval of a Fifth descending or Fourth ascending, we obtain by this means a series of harmonies which are closely linked together. "Commencing with the Tonic chord," he remarks, "we can quit this only by passing to another chord connected with it, and so on, by means of a linked succession of harmonies, we are finally obliged to return to the Tonic chord, and to conclude";¹ as for example:—



So that "harmonic succession is nothing but a connected series (*enchainement*) of Tonics and Dominants."² It is indeed little else than a succession of cadences, in which, the Fundamental Bass descending a Fifth or ascending a Fourth, we find an imitation of the Perfect Cadence. The effect of the cadence may nevertheless be avoided by adding a Seventh to the second chord; dissonance then destroys the effect of repose, and impels the harmony onwards, for every dissonant chord urgently demands resolution. "Every *Dominant* chord," he says, "should resolve in the same way as the *Dominant-Tonic* chord, the fundamental bass rising a Fourth or falling a Fifth. This progression represents a species of Perfect Cadence. The Perfect Cadence, although imitated in this way, should however be avoided by adding a Third [Seventh] above the second chord forming this cadential progression, thus making the second chord a *Dominant* in its turn, *e.g.* :—



¹ *Traité*, Book II., Ch. 22.

² *Ibid.*, Book III., Ch. 27.

This is necessary, as the 'perfect' chord should be heard only on the Tonic." ¹

The manner in which this works out in practice may be seen from the following example, taken from the same section of the *Traité* (*De la manière d'éviter les Cadences, en les imitant*), and which is surely as heavy and inflexible a piece of music as one could well devise:—

The musical score consists of three systems, each with a Continuo part (treble clef) and a Fundamental Bass part (bass clef). The notation is highly complex, featuring many accidentals and figured bass symbols.

System 1:

- Continuo:** Treble clef, notes with various accidentals (sharps, naturals, flats) and figured bass symbols (7, 7, 7, 27, 6, 7, 4, 6, 7, #6).
- Fundamental Bass:** Bass clef, notes with various accidentals and figured bass symbols (7, 7, 7, b7, 7, 5, 7, 6 (!), 7, #7).

System 2:

- Continuo:** Treble clef, notes with various accidentals and figured bass symbols (25, 7, 7, 6, 7, 6, 7).
- Fundamental Bass:** Bass clef, notes with various accidentals and figured bass symbols (27, 7, 7, 7, 27, 7, 7).

System 3:

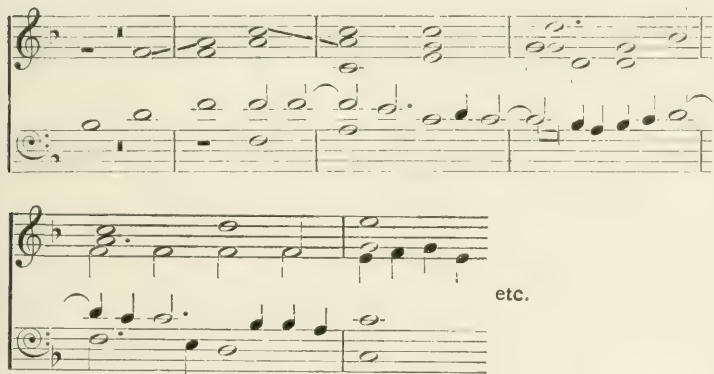
- Continuo:** Treble clef, notes with various accidentals and figured bass symbols (7, 7, 7, 27, 6, 7, 4, 6, 7, #6).
- Fundamental Bass:** Bass clef, notes with various accidentals and figured bass symbols (7, 7, 7, b7, 7, 5, 7, 6 (!), 7, #7).

When we compare this with his music for the clavier, or his operatic music, both of which are distinguished by the greatest clearness, directness, and refinement of the harmony, Rameau appears to us like a doctor who has not the courage, or is too wise, to follow his own prescriptions.

¹ *Traité*, Book II., Ch. 9.

It is not difficult to understand why Rameau regards the "perfect" chord, wherever found, as a Tonic chord, and why, although he finds himself obliged in his "rule of the octave" to place this chord not only on the Tonic but on the Dominant and Subdominant, and although in his own music for the stage he makes use of the "perfect" chord not only on these three degrees of the scale, but on other degrees as well, he nevertheless persists in asserting repeatedly throughout the *Traité* that the "perfect" chord should be placed only on the Tonic; and this notwithstanding the manifest contradiction involved, and the obvious impossibility of reconciling his principles with his practice. In the first place, Rameau stood much nearer than musicians of our day to the polyphonic music of the Church composers, in which successions of consonant harmonies were frequently used in such a way that the *key*, in our sense of the term, was quite undetermined.

Take for example the following passage, selected at random from a work by Palestrina:—



Rameau's meaning then, when he states that such a series of harmonies represent so many Tonics, is clear.

In the second place, if it be true that every succession of consonant harmonies represents as many Tonics as there are sounds in the Fundamental Bass, then such a fact supplies Rameau with a reason for the use which is made in music of

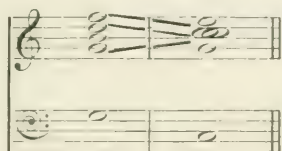
dissonance, and of dissonant chords of the Seventh. Both in the *Traité* and in his later works, Rameau makes his position here perfectly clear. Without the use of dissonance, he tells us, and of dissonant chords, the key cannot properly be determined. Thus a Dominant-Tonic succession, in which both harmonies are consonant, does not constitute a real Perfect Cadence, that is, one which properly determines the key; for "if two 'perfect' chords follow one another in a Perfect Cadence, one is unable to judge which of these chords is the true chord of repose."¹ It is dissonance then that determines the key, and it is dissonance that obliges the chord of the Dominant Seventh to resolve on the Tonic chord. "As soon as the leading-note appears in a dissonant chord it is certain that it determines a conclusion of melody, and therefore it must be followed by the "perfect" chord upon the key-note; whereas if the leading-note does not appear in a dissonant chord, the conclusion is not determined."² It is only, in fact, when the leading-note appears as a dissonant note, and as a constituent of the chord of the Dominant Seventh, that it has the power to determine the key; its *leading* quality is due to this circumstance. "The major dissonance can never appear without the minor."³ If the minor dissonance (the Seventh of the chord of the Dominant Seventh) is not actually present in the first chord of the Perfect Cadence, it must be understood.⁴ Dissonance, then, and the necessity for its resolution, determines the Perfect Cadence, and consequently the key. In taking up this position, Rameau appears to have completely forgotten his former definition of the Perfect Cadence.⁵

Here we are at the source of the doctrine of *Tonality* so vigorously propounded by Fétis, to whom the works of Rameau were known, and who considered that the tonality of our modern music has been determined by the necessity for resolving the two dissonant notes (the Third and Seventh) of the chord of the Dominant Seventh; and of the theory, also so widely disseminated by Fétis, that the revolution which marked the change from the old to our present harmonic art was brought about by Monteverde, who is supposed to have first made use of the chord of the Dominant Seventh.

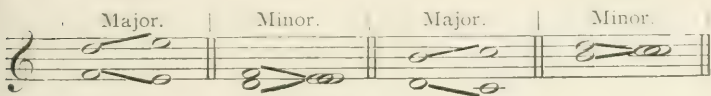
¹ See p. 111. ² *Traité*, Book III., Ch. 14. ³ *Ibid.*, Book IV., Ch 15.

⁴ Book III., Ch. 13. ⁵ See p. 105.

It is in the chord of the Dominant Seventh that we find both dissonances, the major dissonance, which rises a semitone, and the minor, which falls a semitone or tone. Rameau repeatedly dwells on this fact, as though it contained for the theory of harmony some hidden significance the full import of which he is unable completely to fathom. He gives various examples of this harmonic progression in which he points to the *natural*, almost irresistible tendencies of the dissonant notes of the Dominant Seventh chord, one of which is impelled upwards, the other downwards, a degree :—



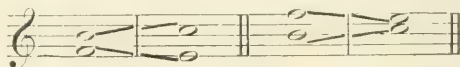
Not only does Rameau lay great stress on this fact, he tries to discover a reason for it. He thinks that the old rules of the contrapuntists regarding the progression of intervals furnish him with a solution of the problem. He quotes the rule given by Zarlino to the effect that every major interval should be followed by one which is greater, and every minor interval by one which is less,¹ thus :—



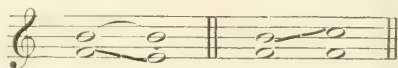
therefore in the chord of the Dominant Seventh, as *g-b-d-f*, *b* naturally rises, while *f* falls a semitone. What is true of major and minor intervals is true also of augmented and diminished intervals ; therefore the Tritone *f-b*, which includes both the dissonant notes of the Dominant Seventh chord, should be followed by the minor sixth *c-c* ;

¹ *Traité*, Book II., Ch. 5.

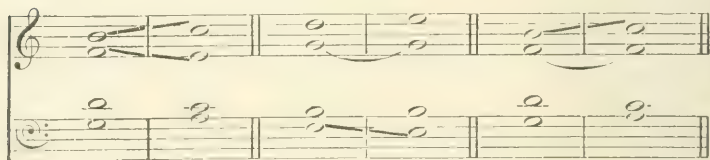
while its inversion, the diminished Fifth, should be followed by the major Third *c-e* :—



This explanation, if it be an explanation, of course does not suffice. For the Tritone may resolve in other ways, as, for example :—



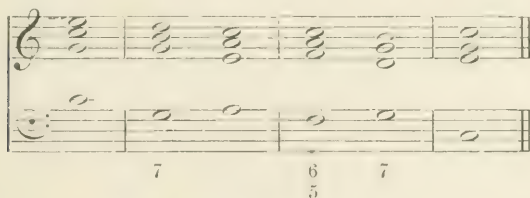
Here it is followed by the perfect Fifth, which is a much more consonant interval than the minor Sixth, and which ought to be considered to provide a much more perfect resolution. So also Rameau's explanation supplies no reason why the chord of the Dominant Seventh should not resolve quite naturally on other chords besides that of the Tonic :—



Such being the case, it is evident that it is not the chance addition of a dissonant note above the Dominant harmony which is the cause of the tendency it undoubtedly has towards the harmony of the Tonic. It should also be remembered that Rameau is quite unable to give any adequate explanation as to the principle which should govern the formation of dissonant chords. For the Dominant discord he adds a Seventh; for the Subdominant discord a Sixth, above the "perfect" chord; but he is unable to tell us why the dissonance of the Dominant, as well as of the Subdominant discord, should not be that of the Added Sixth. As matters stand, the fourth degree of the scale appears to have strayed by chance into a harmony with which it has nothing to do, and of which it forms no part.

In arguing as he does, Rameau does not appear to observe that he is bent on destroying his system of the Fundamental Bass. It is no longer the Fifth progression of the Fundamental Bass that gives to the Dominant-Tonic harmonic succession its "perfection"; the origin even of such a succession is to be found in Dissonance and the necessity for its resolution; and if Rameau is still prepared to maintain that the cadence in question is more "perfect" than any other harmonic progression, then this must be owing to some undefined quality in the dissonance which necessitates the chord of the Dominant Seventh being succeeded by that of the Tonic. Nor does he notice that he puts himself in dangerous contradiction with his cherished principle that melody has its origin in harmony, that it is harmony which determines the notes of the scale, and not the notes of the scale nor the melodic tendencies, real or imagined, of such notes, which determine harmony and harmonic succession.

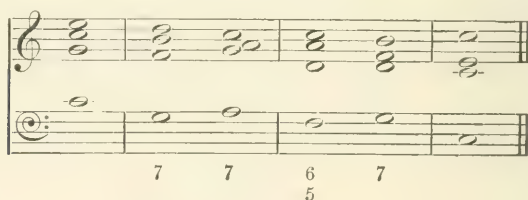
Such then, according to Rameau, is the explanation of the necessity for Dissonance in music. Consonance is the attribute of the Tonic alone; only the Tonic may bear a consonant harmony. In every other case the chord should be dissonant; and where, in such cases, the dissonance is not actually present in the chord, it must nevertheless be understood. In the following:—



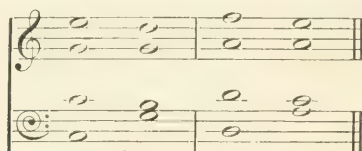
Rameau would regard the Dominant triads as in reality representing chords of the Dominant Seventh; while the Subdominant chord he would consider to represent the first inversion of the chord of the Seventh on the Supertonic (chord of "*grande sixte*"). He not only repeatedly states that every chord except that of the Tonic must be

regarded as dissonant, whether the dissonance is actually present or not, but he also remarks: "In composition of two or three parts, it frequently happens that only the *consonant notes of a dissonant chord* are actually heard; . . . we have already said that a consonant chord can appear only after a discord in which the leading note is present" (that is, in the Perfect Cadence), "for otherwise we pass from one discord to another, as appears from our rules of the Seventh; and this is a little difficult to discover in compositions of two or three parts."¹

In fact, every chord except that of the Tonic is or represents a chord of the Seventh. To test the truth of this statement it is only necessary to add the dissonant Seventh to *all* the chords of the above example, except that of the Tonic. The result can hardly be said to improve matters:—



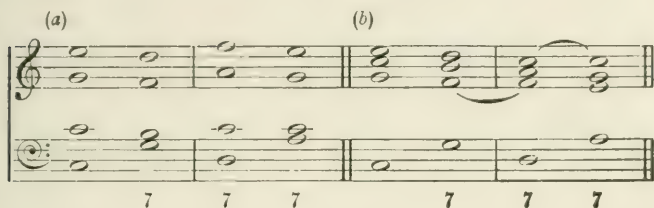
In the same way, if the following successions of harmonies:—



really represent chords of the Seventh, we immediately find ourselves in a sea of difficulties. According to Rameau, we ought to understand the passage as at (a); or as at (b)

¹ *Traité*, Book III., Ch. 18.

where the chords are linked together as closely as possible :—



But here, as formerly, the Seventh cannot be added without flagrantly transgressing Rameau's own rules for the preparation and resolution of discords. The simple successions of harmonies, which in themselves are easily understood by the ear, are made unrecognizable and unintelligible. But Rameau himself, as we have seen, found it impossible to apply this part of his theory to practice, and was obliged to admit that the Dominant, Subdominant, and indeed other degrees of the scale as well as the Tonic may bear a consonant harmony.

Yet Rameau, in dealing with this subject, proves himself to be possessed of an extraordinarily fine ear, and of a keen musical perception. He clearly perceives that the "perfect" chord in itself has no tendency one way or another ; it is consonant, in a state of rest, and such is the impression which it conveys to the mind. He also perceives that it is only when this chord appears on the Tonic that the impression of complete repose is produced. It is only then, and especially when it is the second chord of the Perfect Cadence, that the ear is fully satisfied, and desires nothing more to follow. On the other hand, when the "perfect" chord is not apprehended as a Tonic-chord, as a harmonic centre, it does not produce, like the Tonic harmony, the feeling of complete repose ; the mind is not satisfied, but desires and expects some other harmony to follow ; thus we are obliged to proceed from chord to chord until we again reach the Tonic chord, and attain a satisfactory conclusion.

It is not surprising that Rameau should be unable to give a clear presentation of this fact, nor that he should give the

wrong explanation of it. What is surprising is that Rameau, the first to grapple, in any real sense, with the mysteries of our harmonic system, should have been the first to bring to light facts of such importance for the science of harmony.

Of the part played by Rhythm in music, Rameau does not treat to any considerable extent, although his remarks on the subject show that he realizes its importance. "So great is the influence of Rhythm in music," he says, "that it alone is capable of exciting in us the various passions which we generally consider to demand, for their expression, the use of harmony."¹ He points to the fact that the Cadence depends for its effect on Rhythm as well as harmony, but he does not attempt to explain why this should be so. Noteworthy is the remark that the principle of Rhythm, or Metre (*Mesure*) in which the numbers two, three, and four are made use of, is the same as that of harmony.² This is the root-idea from which Moritz Hauptmann has evolved his metrical system in his important work *Harmonik und Metrik* (1853).

MELODY HAS ITS ORIGIN IN HARMONY: THE NATURE AND CONSTITUTION OF THE SCALE.

"It would at first seem," says Rameau, "that harmony has its origin in melody; that it was the result of the union of melody notes produced by the different voices. But it is necessary to determine the course which each of these voices must follow in order that they may accord together; and this can only be effected by means of the rules of harmony. It is therefore Harmony, not Melody, which guides us."³ Again, it is the fundamental principle of harmony, the arithmetical division of a string, which supplies the essential notes of the Mode or scale, that is the Tonic, Mediant, and Dominant. It is true that the intervals thus obtained do not suffice; for the scale and for melody smaller intervals are necessary. But these smaller intervals, which are the tone and semitone, although they cannot be directly derived

¹ *Traité*, Book II., Ch. 23.

² *Ibid.*, Ch. 23.

³ *Ibid.*, Chs. 19 and 21.

from such a principle, are nevertheless derived indirectly, by means of the progression of the Fundamental Bass. Thus the two Cadences, the Perfect and the Irregular Cadences, furnish us with all the notes necessary for the formation of the scale. Therefore, concludes Rameau, it is evident that *Melody has its origin in Harmony*.

He is nevertheless quite well aware of the fact that purely melodic music was for many centuries the only kind of music in existence, that it was extensively practised long before composers began to make use of harmonic music, and that the melodic music in use among the Greeks, the Romans, and in the early Church was based on a well-defined system of Modes or scales, which like our modern modes were diatonic, consisting of five tones and two semitones. This fact causes him considerable uneasiness. "The ancients,"¹ he says, "have defined perfectly well the properties of the Modes, to which they subjected both harmony and melody, of the nature of which however they were ignorant. The effect of all melody, they considered, depended on these Modes. Why then should they have altered them, especially in the Cadences, and tried to imitate the notes of our perfect system."² According to the ancients, there was no sub-semitone in the modes on *Ré*, *Mi*, *Sol* and *La* [that is, the Dorian, Phrygian, Mixolydian and Æolian modes], and yet they considered that it was necessary for a proper Cadence to alter these modes chromatically so as to obtain this sub-semitone [leading note!]. If they had paid some respect to harmony, they would not have fallen into errors so gross. Thus we see how vainly people without taste, full of the rules of the ancients, of which the true meaning is unknown to them, attempt to furnish a good and agreeable harmony to different kinds of Plain Chant. . . . The blindness of these old musicians is apparent also from the manner in which they divided their modes into Authentic or principal, and Plagal or collateral. The harmonic and arithmetical proportions ought to be applied only to harmony, not to melody. . . . If Zarlino had been of the same mind as Plato, who as he himself tells us considered

¹ Rameau is here referring to composers and theorists of and before the time of Zarlino.

² That is, our major and minor modes.

that melody has its origin in harmony, he would have sought for the foundations of modulation [scale, mode] in this harmony."¹

It is evident that the music of the "ancients" is for Rameau a source of the greatest perplexity. He cannot understand it: it refuses to accommodate itself to the rules of his Fundamental Bass. But although Rameau finds himself at fault with regard to the music of the polyphonic period prior to the 17th century, it by no means follows that the harmony of polyphony had its source in melody. Rameau furnishes a strong argument against such a view when he points to the fact that the melody of the polyphony of this time was not arbitrary, for it was necessary to shape the various melodies in such a way that they should harmonize together. It is frequently stated that the music of early polyphony ought to be considered from a *horizontal* point of view, that is, as so many voice-parts or melodies woven together so as to produce harmony. We of the present day, on the contrary, regard music from a *vertical* point of view. There is much truth in this, if it be taken to mean that polyphony is the art of combining melodies, of fitting them together in such a way as to produce harmony, and not that the harmony is the result of the fortuitous concurrence of the various melodic parts. Rameau does not in his *Traité* enter into further particulars as to the nature and origin of the scale, whether major or minor. He does not treat of the Minor Scale as an independent scale, but relates it to the major; the rules for the Major Mode, he tells us, are applicable also to the minor. So also one is at liberty, if the expression demands it, to substitute for a Major Mode its Tonic minor, "as frequently happens in *Chaconnes* and *Passacaglias*."

So then, we are asked to observe, we find that all harmony, whether major, minor, consonant or dissonant, all scales, modulation and melody, the Fundamental Bass and the rules for harmonic succession, the Cadences, the Major and Minor Modes—"all that is necessary for a good and agreeable harmony" are "derived from our fundamental principle which is based on the first divisions of a string"; a somewhat large claim which, as we have

² *Traité*, Book II., Ch. 21.

seen, Rameau is far from being able to establish ; although, in his laborious researches, he has succeeded in bringing to the light results of real and lasting value for the science of harmony.

In 1726, four years after the appearance of the *Traité de l'harmonie*, Rameau published the *Nouveau Système de Musique Théorique*, written "in order to serve as an introduction" to the former work. We therefore find again, although in a much more concise form, the main outlines of the theoretical principles already set forth in the *Traité*. But Rameau's ideas on the subject of harmony have in the interval undergone some development.

PART II.

CHAPTER V.

RAMEAU'S *NOUVEAU SYSTÈME DE MUSIQUE*
THÉORIQUE (1726).

FROM the Preface to his *Nouveau Système* we learn that during the time which has elapsed since the publication of the *Traité*, Rameau has made himself acquainted with the results of the acoustical researches of Mersenne and Sauveur,¹ especially as regards the natural resonance of sonorous bodies (harmonics, partial-tones). He has discovered that the sounds arising from the first divisions of a string, which have furnished him with his fundamental principle of harmony, are actually present in the string during its vibration, and may actually be heard; that the string or other sonorous body not only vibrates in its totality, that is, throughout its whole length, but in vibrating *naturally* divides itself into sections, (segments), which vibrate independently; these sections corresponding exactly with those resulting from the harmonic division ($1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}$, etc.) of the sonorous body.

This is for Rameau a wonderful fact, as in truth it is. Having followed him thus far in his operations, we can well appreciate with how much force such an acoustical phenomenon must have impressed itself upon him. He had toiled with "the help of mathematics," "by reason alone," to discover the natural principles of harmony, and to prove that

¹ Joseph Sauveur (1653-1716), a distinguished French acoustician and mathematician, was one of the first (although deaf from his birth) to investigate the phenomena of partial tones. His works include: *Principes d'acoustique et de musique* (1700); *Application des sons harmoniques à la composition des jeux d'orgue* (1702); *Rapports des sons des cordes d'instruments de musique aux flèches des cordes, et nouvelles déterminations des sons fixes* (1713); also other works treating of systems of temperament.

harmony has a natural basis, while all the time a greater artificer had been at work before him! What a revelation! Harmony is the direct gift of Nature. From this sounding body, which breaks itself up into sections, there proceeds "the most perfect harmony" of which the mind can conceive. This now becomes the fact of primary importance for Rameau. From this time onwards the nature of the sonorous body is the theme which is hardly ever absent from his lips. It becomes his battle-cry in the controversies with Rousseau, d'Alembert, and others of the French "Encyclopædists," in which he was shortly to find himself engaged. He champions it as the key to the theory of harmony. That a musical sound is not simple, but composite, and that in a well developed musical sound we hear not only the primary fundamental tone, but other secondary tones, which unite with it, and together form the "perfect harmony"—Zarlino's *Harmonia Perfetta*—the harmony of Nature, that it is in this natural phenomenon that the whole art of music and of harmony have their origin, and from which they take their development—on these things Rameau lays the greatest possible stress, and dwells on them with almost tiresome iteration.

Rameau is overjoyed at what he considers to be such a striking confirmation, given by Nature itself, of the correctness of his theoretical principles, and of the Fundamental Bass. "How can one fail to be convinced," he says, "of the truth of the Fundamental Bass, seeing that the three fundamental sounds from which it is developed naturally arise not only from the divisions of a string, but are found in a [musical] sound of the human voice itself. . . . There is indeed within us a germ or principle of harmony. Harmony may be said to be natural to us; and in the fact that these three sounds are heard in a sound produced by the voice the author has found the strongest possible confirmation that here was the true principle of the Fundamental Bass, whose discovery he owes to experience alone."¹

A considerable part of the *Nouveau Système* is occupied by Rameau in citing every acoustical phenomenon which he imagines can in any way serve to demonstrate the correctness of his theories. He lays greatest stress however on the

¹ Preface.

fact that the three sounds which together form the perfect chord (that is, a fundamental sound together with its upper partial tones of the Twelfth and Seventeenth), must be regarded as a product of Nature. These sounds may be distinguished not only in the tones produced by the strings of the violoncello, but may also be heard "in cymbals, and in the lowest sound of the trumpet, in bells, etc." He points also to sympathetic vibration as a proof of the close relationship which exists between the three sounds in question. "Those," he says, "who are unwilling to trust their ears may however accept the evidence of their eyes. For if one takes three strings of the violoncello, and tunes one of them a twelfth and the other a major seventeenth above the lowest string, the latter in being made to vibrate powerfully will make the other two strings vibrate also, in such a manner that these vibrations may be perceived by the eye as well as by the ear."¹

Strings which are tuned to the Octave or Unison of the fundamental sound are most readily affected in this way; but although they are made to vibrate more powerfully than the sounds of the Twelfth and major Seventeenth, they are not so distinctly heard. "The greater the uniformity existing between sounds, the less easily can they be distinguished from one another."² The following statement, which Rameau considers to have a bearing on temperament, is not quite accurate: "It is yet to be remarked that a Fifth, if slightly diminished, will still co-vibrate; whereas the Unison, Octave and [major] Third will not co-vibrate if altered to the slightest extent; whence we must conclude that this slightly diminished Fifth cannot be displeasing to the ear, as is proved by experience, in the tuning of organs and clavecins."³ Rameau ought rather to have concluded that although the correspondence which exists between the judgment of the ear and acoustical fact may be, and is, of importance for physical science and for the theory of harmony, the ear does not suspend its judgment in respect of the consonance or dissonance of intervals until it has been ascertained whether this correspondence exists, but promptly decides for itself. All the intervals he mentions and not the Fifth only may be slightly altered, and still co-vibrate. Rameau,

¹ *Nouveau Système*, Ch. I.

² *Ibid.*

³ *Ibid.*

although one of the most honest of theorists, occasionally permits his scientific observation to be affected by the necessities of his theory. Here the necessity is one connected with temperament. In the *Nouveau Système* Rameau favours the unequal or mean-tone temperament, in which the Fifths are slightly altered, the minor Thirds likewise but to a larger extent, while the major Thirds are made as just as possible. This system he abandoned later in favour of equal temperament.

RELATIONSHIP OF HARMONY AND THE FUNDAMENTAL BASS
TO MATHEMATICAL PROGRESSIONS: THEORY OF THE
SUBDOMINANT.

Rameau does not in the *Nouveau Système* attempt to express, by means of ratios, the relative degrees of consonance and dissonance pertaining to the various chords used in harmony; he contents himself with quoting Descartes to the effect that "objects, in order to please, ought to be disposed in such a manner that they do not appear confused to the senses, so as to cause these to labour in order to distinguish them."¹ For this reason the Octave (1:2) is a more perfect consonance than the Third (4:5). Nevertheless, Rameau cannot give up the idea, which forms his starting-point in the *Traité*, that a close connection exists between mathematics and music. Accordingly, we find this idea taking shape in a new form.

He says: "From the three sounds $\left[\begin{array}{c} \text{Fundamental,} \\ \text{Twelfth} \quad \text{and} \quad \text{Seventeenth} \\ \text{3} \quad , \quad \text{5} \end{array} \right]$ which result from the resonance of a sonorous body, we obtain the following proportions or progressions:—(1st) the Arithmetical progression 1:3:5, which is determined by the difference between 1 and 3, and from which the perfect [major] harmony is derived; (2nd) the Geometrical progressions determined by the relationship between 1 and 3, and between 1 and 5; that is, a triple progression 1, 3, 9, 27, etc., or progression by Fifths; and a quintuple progression 1, 5, 25, 125, etc., or progression by Thirds."² (for the Twelfth 1:3 is merely a compound

¹ *Nouveau Système*, Ch. 2.

² *Ibid.*, *Preliminaries*.

form of the Fifth 2 : 3, and the Seventeenth 1 : 5 a compound form of the Third 4 : 5). "The arithmetical progression [1 : 3 : 5] gives us the most perfect of all the chords; the Geometrical progression [1 : 3 : 9] gives, in its turn, the most perfect harmonic succession."¹ "From chords and their progressions will arise *modes, modulation, and melody*."²

Rameau's theory now takes a notable development. In the *Traité* he is quite aware of the unique position occupied by the Tonic chord. It alone is truly consonant; it alone can produce the effect of finality, of absolute repose. He is also aware of the importance which attaches to the harmonies on the Fifth and on the Fourth degrees of the scale. The progression of the first of these two chords towards the Tonic harmony produces the Perfect (Authentic) Cadence, while the progression of the second towards the same harmony gives us the "Irregular" (Plagal) Cadence. But while the Perfect Cadence may be explained as a harmonic progression in which "the Fifth returns to its source," "the Irregular" Cadence does not admit of a similar explanation. Nevertheless, Rameau is convinced, not only the chord on the fifth degree, but also that on the fourth degree of the scale is a Dominant: both chords "announce" the Tonic harmony. Here now the thought strikes him:—if both chords are Dominants, is not the relationship to the Tonic harmony in each case that of the Fifth? It is he finds indeed so. The harmony on the fifth degree of the scale is that of the Fifth *above* the Tonic; while the harmony on the fourth degree of the scale is that of the Fifth *below* the Tonic. *Every Tonic therefore has two Dominants, an upper Dominant and a lower Dominant, or Subdominant.* This Rameau considers to be fully demonstrated by the triple progression C—G—D 1 : 3 : 9, or progression in Fifths, in which the central term $\frac{G}{3}$ may be taken to represent the Tonic, $\frac{D}{9}$ the Dominant, and $\frac{C}{1}$ the Subdominant. Here the real relationship of both Dominants towards the Tonic is clearly perceived, while at the same time the Tonic is determined as the central sound, and the Tonic harmony as the Harmonic

¹ *Nouveau Système*, Ch. 2.

² *Ibid.*, Ch. 4

Centre to which both Dominants are related, and towards which both tend to proceed.

This geometrical progression. $1 : 3 : 9$, Rameau tells us, not only determines the fundamental bass in Fifths, it determines also harmonic succession. "In order," he says, "that the fundamental sound, the Tonic, may be at liberty to proceed either upwards or downwards, we shall assign to it the number 3, and describe it as G : thus—

C—G—D This fundamental sound $\overset{G}{3}$ will commence and
 $1 : 3 : 9$ finish the harmonic progression, and will proceed in
differently either to $\overset{D}{9}$ or $\overset{C}{1}$. It is necessary to remark,

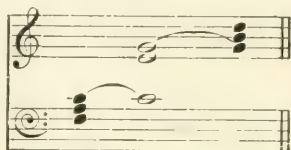
however, that $\overset{C}{1}$ and $\overset{D}{9}$ cannot immediately succeed one another without detriment to the triple progression. . . . As the Fifth 9 is heard or at least understood when 3 is sounded, one naturally prefers that 3 should proceed to 9, its Fifth above, rather than to 1, its Fifth below. Therefore the most perfect progression of the fundamental sound is to proceed to its Fifth above. On the other hand, the most perfect progression of this Fifth is to return to the fundamental sound, for returning then as to its source one desires nothing further after such a progression, which arises from the inversion of the first."

Thus for the first time in the history of musical theory we find the fourth degree of the diatonic scale described as the Subdominant, and defined as the Fifth below the Tonic. Rameau evidently regards his discovery of the Subdominant as of the greatest importance; it is for him the keystone of his theory. As a matter of fact, Rameau's explanation of the relationship existing between the Tonic and its two Dominants not only forms one of the most important features of his own theory of harmony, but has had the greatest possible influence on the theory of harmony as a whole. The term Subdominant was soon in general use. At the present day it is constantly used by musicians even who are unacquainted with Rameau's explanation of it: and, what is more remarkable still, by musicians and theorists who, although acquainted with Rameau's theory of the Subdominant, nevertheless reject it, and give to the Subdominant a Dominant "root."

It is then, according to Rameau, not only between the Tonic and the fifth degree of the scale, and between their harmonies, that there exists a Fifth relationship, while the fourth degree of the scale with its harmony appears to occupy an isolated position:—



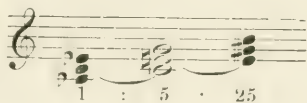
The fourth as well as the fifth degree has this Fifth relationship, the one appearing above and the other below the Tonic. Thus not only is the relationship which both bear to the Tonic correctly determined, but the Tonic itself, standing midway between its two Dominants, appears in its true character as principal or determining note or chord. Could anything be more symmetrical, more natural?—



Is it not, asks Rameau, in entire accordance with "experience," with the judgment of the ear? Whether this be so or not we must ask:—What exactly does Rameau mean when he speaks of a Subdominant which is a Fifth below the Tonic? His reference to the Fifth above the Tonic can be understood; this Fifth or Twelfth, he has pointed out, forms part of the resonance of the fundamental sound or Tonic. But where is the Subdominant, or any sound which represents it, to be found? It forms no part of the resonance of the fundamental sound. In short, the Tonic has no Fifth below. Of the two sounds F-C, F cannot be regarded as Fifth of C; on the contrary C must be considered as Fifth of F. In the Subdominant harmony, F-A-C, Rameau himself considers F to be the fundamental note of which C is the Fifth.

It is chiefly in order to obviate this difficulty that Rameau has recourse to the geometrical progression 1 : 3 : 9; here, he tells us, 3 may represent the principal sound or Tonic,

whereby the Fundamental Bass has the liberty to proceed from this central sound either upwards to its Dominant (9), or downwards to its Subdominant (1). But Rameau merely assumes what he wishes to prove. He assumes that the Tonic has a lower Dominant, and is unable to state where this lower Dominant is to be found. He assumes that his mathematical progression must be limited to three terms only, whereas it might consist of an indefinite number of terms. He assumes that the middle, rather than one of the extreme terms, should represent the Tonic. He first states that the Fundamental Bass may proceed "indifferently" from the central sound to either of its Dominants, but afterwards corrects this statement, and points out that the natural tendency of the Fundamental Bass is to the upper rather than to the lower Dominant. But it is certain that there is nothing in the mathematical progression $1 : 3 : 9$, which indicates any such tendency or preference on the part of the Fundamental Bass. Of the quintuple progression, or progression in Thirds, Rameau does not state whether he considers that this, like the other progression, should consist of three terms only, of which the middle term should represent the Tonic. Obviously there are considerable difficulties in the way of such an arrangement:—



Rameau, then, does not appear to reap much benefit from his new use of mathematics; his triple and quintuple proportions do not enable him to throw much additional light on the mysteries of harmonic science. Rameau owes his discovery of the Fundamental Bass to his musical intuition, to his keen observation of harmonic facts, and not to mathematics. It is true no doubt that if such a bass, once it has been fixed and conclusively proved, can be shown to correspond with a certain geometrical progression, such a circumstance may be of the highest scientific importance. It is a most important scientific fact that the major harmony corresponds with the first six numbers. But although Rameau has little difficulty in showing that his

triple progression corresponds with a Fundamental Bass in Fifths, and that it may even be considered to determine such a bass, he is quite unable to show that there is anything in this progression which corresponds with or even suggests his theory of a Subdominant. The progression would appear to indicate, on the contrary, that there is no Subdominant. We have seen that Rameau selects the middle term, 3, of the

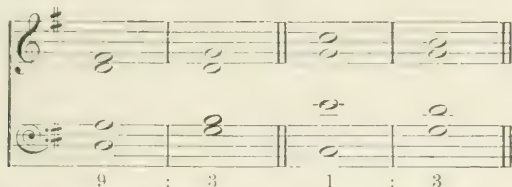
progression $\overset{C}{1} - \overset{G}{3} - \overset{D}{9}$ (more correctly $\overset{C}{1} : \overset{G}{\frac{1}{3}} : \overset{D}{\frac{1}{9}}$) to represent the principal sound or Tonic. But the only term which Rameau can make use of with any show of reason for this purpose is the first, that is unity. In formulating his mathematical progressions, in the *Préliminaires de Mathématique*, which is prefixed to the *Nouveau Système*, he bases all his operations on the principle that 1, or Unity, represents the fundamental and principal sound to which the other sounds are related. In the geometrical progression $\overset{C}{1} - \overset{G}{\frac{1}{3}} - \overset{D}{\frac{1}{9}}$ $\overset{C}{1}$ should therefore represent the Tonic; $\overset{G}{\frac{1}{3}}$ is its Fifth, while $\overset{D}{\frac{1}{9}}$ is the Fifth of $\overset{G}{\frac{1}{3}}$. It is evident, also, that

$\overset{G}{\frac{1}{3}}$ cannot represent the Tonic, because it is itself a related and a determined sound: it is the Fifth of $\overset{C}{1}$. Rameau's difficulty however can be easily understood. For if in the triple progression 1, or unity, represents the principal sound, the Tonic, it will be impossible to discover the Subdominant.

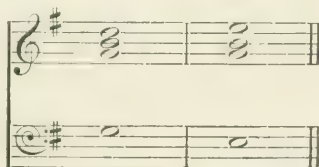
Still, the Subdominant is a harmonic fact, a fact of experience. Of Rameau's successors not one has succeeded in finding for it an adequate explanation. Some do not realise the nature of the difficulties connected with it. Others appear to be unconscious of the part played by the Subdominant in the establishment of our key system, and to be unaware that any explanation is required. Until the nature of the Subdominant is known, it might be rash to assume that Rameau's proportions and progressions have no significance for the theory of harmony.

THE MAJOR AND MINOR MODES : THE CHROMATIC SCALE.

From the triple progression, or Fundamental Bass in Fifths,—



we obtain all the notes of the major scale in their correct proportions, thus :—
 $G - A - B - C - D - E - F\# - G$
 $24 : 27 : 30 : 32 : 36 : 40 : 45 : 48$
 The Minor Mode, Rameau says, arises from a Fundamental Bass in Thirds ; that is—



where the first chord represents the major Tonic chord, and the second the Tonic chord of its relative Minor Mode. “The numbers $\overset{E-G}{5 : 6}$ indicate to us the relationship existing between the major and minor modes, and explain the liberty we possess of passing from the one mode to the other, by means of a Fundamental Bass in Thirds.”¹ Rameau however does not explain whence he derives the liberty of making the Fundamental Bass descend a minor Third. His quintuple progression $1 : 5 : 25$ is composed exclusively of major Thirds.

In order, then, to obtain the notes of the minor scale, Rameau takes the chord $E-G-B$ as a Tonic chord : E now represents the middle term of a triple progression, and may proceed as in the Major Mode to B its Fifth above, or to

¹ *Nouveau Système*, Ch. 6.

A, its Fifth below. But now a difficulty arises, for if these sounds are assigned the same proportions as in the Major Mode, they cannot represent the triple progression. The terms $A - E - B$ or, $A - E - B$ do not correspond with those of the triple progression $1:3:9$; the ratio $27:40$ does not represent the correct proportions of the perfect Fifth ($2:3$), but one diminished to the extent of a comma ($80:81$). If, on the other hand, the proportions assigned to the sounds of the Fundamental Bass are $A - E - B$ $27:81:243$, so as to make them conform to those of the triple progression, we find that E, the Tonic, which in the relative major scale has the term 80, is now assigned the term 81! Although Rameau is aware of these defects, he imagines that they only furnish proof of the necessity for temperament. "If," he says, "we do not discover the triple progression in the terms given to the sounds A-E-B [*i.e.*, $27:80:240$] this is because we have given to E the proportion 80, the replica of 5, instead of 81; otherwise we could have found it in $A - E - B$ $27:81:243$. We have done this purposely, however, as it shows the necessity for temperament."¹ It is thus that Rameau, whose entire system is based on the acoustical correctness of intervals, on just intonation, takes refuge in temperament, that blessed haven of many a distressed theorist. Although he is unable to discover a Fundamental Bass for the Minor Mode, he nevertheless assigns to the degrees of this mode in its Melodic form the following proportions— $E - F\sharp - G - A - B - C\sharp - D\sharp - E$ $80:90:108:120:135:150:160$. In the descending form of this scale the sixth and seventh degrees, both of which are lowered a (chromatic) semitone, should have the proportions $C\flat - D\flat$ $128:144$. He says little as to why the ascending form of this scale should differ from the descending form. "The sounds $C\sharp, D\sharp$," he remarks, "can only be used in the ascending scale; in descending, the

¹ "Nous n'avons affecté ce défaut que pour en préparer les voyes; d'autant qu'il est absolument nécessaire dans le temperament." (*Nouveau Système*, Ch. 6).

scale contains the same notes and the same diatonic proportions as the relative major scale ; whereby we see the close relationship which exists between the two modes." ¹ Here we find a new explanation of the relationship existing between the major and minor Modes. Rameau has previously explained this relationship as arising from a descending Third-progression of the Fundamental Bass.

Rameau's procedure in respect of the chromatic scale is no less extraordinary. He derives this from the minor scale. This is possible, "because we may place indifferently either the major or minor Third on the fundamental sounds." ² The proportions he assigns to the various degrees of this scale begin with 480 : 512, and terminate with 900 : 960. He is of opinion that the proportions which distinguish the three scales indicate the relative degrees of perfection of these scales. "The major system commences at 24 ; the minor, in which the major is again found, at 80 ; and the chromatic, in which both the major and minor systems find themselves repeated, at 480. . . . The fact that the major system is composed of more simple proportions than the other two systems . . . is a proof that this system is the most perfect." ³

He now imagines that he is in possession of a coherent system of modes, in which everything revolves round a firmly established centre. "In the minor and the chromatic systems we find that the principal sounds of each form a minor chord, namely, E-G-B, in which the Tonic of the major scale holds the central place : this place it also holds in the triple progression, $\overset{\text{C}}{\text{I}} - \overset{\text{G}}{\text{3}} - \overset{\text{D}}{\text{9}}$ so that this sound $\overset{\text{G}}{\underset{\text{3}}{\text{I}}}$ determines on every side the modulation"—

Rameau means the system of modes, as well as harmonic succession within a mode—"whether in the same mode, or in the passage from one mode to another." ⁴ Thus $\overset{\text{G}}{\underset{\text{3}}{\text{I}}}$ the Third of the minor Tonic chord, and the Fifth of $\overset{\text{C}}{\text{I}}$, becomes the central note (Tonic) of the Minor, as well as of the Major Mode !

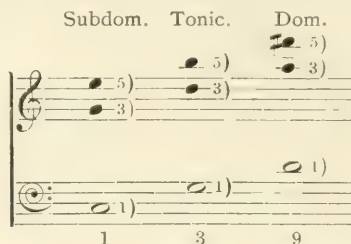
¹ *Nouveau Système*, Ch. 6.

² *Ibid*, Ch. 6.

³ *Ibid*.

⁴ *Ibid*.

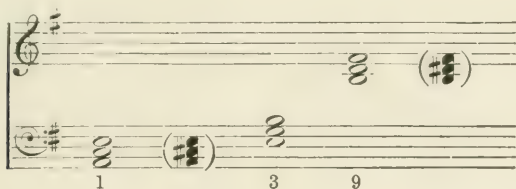
Rameau however is convinced that both the major and minor diatonic systems have their origin in a Fundamental Bass which consists of the three fundamental sounds, Tonic, Dominant, and Subdominant. The Tonic, together with its third and fifth upper partial tones, furnishes us with the three essential sounds of the mode :—



that is, the first, third, and fifth degrees of the scale ; the Dominant, in the same way, gives us the second and seventh degrees, while from the Subdominant we obtain the fourth and sixth degrees of the scale. We are therefore, considers Rameau, in possession of the diatonic scale of G major, consisting of eight sounds arranged in the following order *g-a-b-c'-d'-e'-f#'-g'*. But why does Rameau arrange the sounds in this order ? *g* is fifth of *c*. It is *c*, therefore, which ought to serve as the foundation and starting-point of the whole diatonic succession of sounds, which ought to appear thus : *c-d-e-f#-g-a-b-c'*. Unfortunately, as Rameau is aware, such a scale has no place in our harmonic system.

Even if we accept Rameau's assurance that there is really a Subdominant ; even if we accept his explanation as to the Major Mode, it is important to note that Rameau's substitution, in the *Nouveau Système*, of the physical principle of harmonic resonance for the mathematical principle of the senary division of a string does not lessen his difficulties with regard to the minor harmony and the Minor Mode. On the contrary these become well-nigh insuperable. Rameau considers the major harmony as a *natural* harmony which results from the resonance of a sonorous body. Is not the minor harmony, however, also a *natural* harmony ? But where in Nature is such a harmony to be found ? The harmony which is formed between the prime tone of a musical sound and its first series of partial

tones is invariably major, and can never be minor. Rameau is dealing with an immutable natural law. In the minor harmony $c\flat\text{-}g$, therefore, regarded from the point of view of physical resonance, $c\flat$ appears as a sound which is foreign to the natural harmony of c ; not only so, it contradicts this natural harmony, for $c\flat$ contradicts the true harmonic sound, which is $c\sharp$. Nevertheless, Rameau considers that he is at liberty to give to the sounds of his Fundamental Bass, now a major and now a minor harmony wherever he thinks fit. In the Major Mode the fundamental sounds have major harmonies. It might be considered then that in the Minor Mode all three fundamental sounds should bear minor harmonies. This of course does not suit Rameau. He places here a major harmony, and there a minor one, while the same fundamental sound may at one time bear a minor, and at another time a major harmony, according to the exigencies of the mode :—



DOMINANT AND SUBDOMINANT DISCORDS : DEVELOPMENT OF THE " ADDED THIRD " THEORY OF CHORD FORMATION.

In the *Nouveau Système* we find that Rameau's views on the subject of the Dominant and Subdominant discords, and their use in defining the key, have also undergone some development. " Since we cannot hear a tone," he remarks, " without the ear being at the same time affected by its Fifth and its Third (these three sounds forming the essential notes of the mode), we cannot therefore hear it without being at the same time impressed with its key. . . . It follows that each of the three fundamental sounds which constitute a mode can in turn impress us with the idea of its key, for each bears a harmony equally perfect. In moving from one

to another of these fundamental sounds, there is formed a species of repose. . . . hence there arises an uncertainty as to the key, an uncertainty which can only be removed by the skill of the composer.”¹ The means which should be taken to preserve the impression of the key are Dissonance and Accent (*Mesure*). The harmony which is heard on the strong beat of a bar affects us more strongly than that which occurs on a weak beat. Hence the impression of the key is strengthened by placing the chord of repose on the strong beat.² Accent by itself, however, is not enough. The above principle works both ways, and may be employed to confirm not only the Tonic or central key, but also the keys of its two Dominants, thus:—



From this difficulty we are helped by Dissonance, for if we add a Seventh above the Dominant harmony, and a Sixth above the Subdominant harmony, these chords can no longer be regarded as chords of repose, that is, as Tonic chords. As now only the Tonic appears as a consonant chord, and as further this Tonic harmony should be heard on the accented beat, both accent and dissonance will co-operate to confirm the impression of the key. This is the true explanation of dissonance, which is a necessity in music, and not merely the result of choice or caprice. “The introduction of dissonance into music cannot be justified, unless it is meant to serve some useful purpose; so far however the only explanation advanced has been that by its means a greater variety of harmony has been obtained.”³

In the chord of the Dominant Seventh, as *d-f#-a-c*, Rameau proceeds, we find both Dominants, *D* and *C*, united in a single

¹ *Nouveau Système*, Ch. 7.

² *Ibid.*

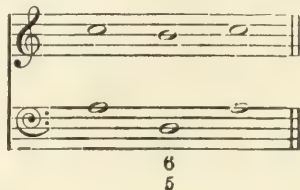
³ *Ibid.*, Ch. 11.

chord. These two Dominants "appear indeed to become united so as to make even more marked that tendency towards a Tonic Close which each of them singly possesses."¹ Such being the case with regard to the Dominant harmony *d-f#-a*, it would appear that the Subdominant harmony *c-e-g* ought to be characterized in a similar way. But we cannot add the upper Dominant *d* to the Subdominant harmony; we can only add the *Fifth* of this Dominant, so that the Subdominant discord appears as *c-e-g-a*, that is, as the chord of the Added Sixth. Hence the superiority which marks the Perfect Cadence, as compared with the Irregular Cadence. "The fruits which we can derive from the union of the Subdominant with the harmony of the Dominant would vanish as soon as we tried to combine this Dominant with the harmony of the Subdominant, since the one is more perfect than the other, and the cadence announced by the one is more perfect than that of the other. It is necessary that the subordination of the one to the other should be preserved. Instead, then, of both Dominants being united in the Subdominant discord, we find only the Fifth of the upper Dominant, which takes its place and, so to speak, represents it."²

This is an important development of Rameau's theory in respect of these chords. It is of course an after-thought: for both chords have their functions determined, and are discussed at considerable length, in the *Traité*. As Rameau in his later works lays great stress on this part of his theory, fuller examination of it may for the present be reserved. In the meantime it need only be pointed out that the explanation of the origin of these chords given in the *Nouveau Système* is practically the same as that given in the *Traité*. The chord of the Dominant Seventh is still considered to arise from the addition to the "perfect" chord of one of its parts; that is, a minor Third is added above the "perfect" chord. As regards the resolution of the Seventh in this chord, Rameau is still of opinion that its natural tendency to fall a semitone is owing to what he calls "the natural progression of the minor Third."³ He even thinks that in the Minor Mode the Third of the Tonic chord, which forms a minor Third with the Tonic, tends to proceed a semitone downwards, so as to form a chord of the "Added Sixth"

¹ *Nouveau Système*, Ch. 12.² *Ibid.*, Ch. 13.³ See p. 125.

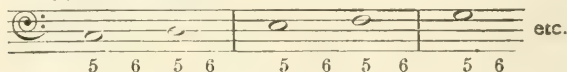
with the Subdominant harmony, rather than rise a tone thus:—



and remarks: ¹ "After having pointed out that the Seventh is derived from the minor Third, it is no longer the Seventh that we ought to consider in order to understand its progression, but the consonance [the minor Third], which is the cause of it." ² This needs no comment.

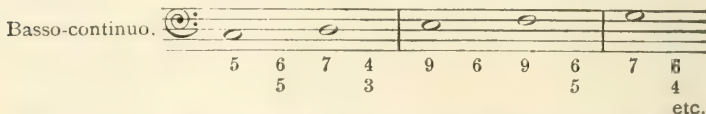
The manner in which Rameau applies his principles to some of the simplest of harmonic progressions not infrequently produces extraordinary results. In the *Traité* he distorts beyond recognition simple contrapuntal passages by Zarlino. In the *Nouveau Système* he gives a revised version of a series of progressions by Corelli:—

CORELLI'S Bass.



which amount to nothing more intricate than a succession of triads and chords of the Sixth above a bass ascending by diatonic degrees, at the same time censuring Corelli for not having indicated more clearly, by means of the figured bass, the real nature of the harmony. "What does one think," he says, "of this method of figuring several notes which ascend diatonically, where nearly every 5 and every 6 should indicate quite a different chord, as follows":—

RAMEAU'S version.



Fundamental Bass.

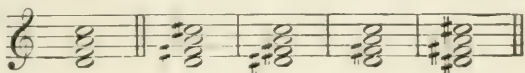


¹ *Nouveau Système*, Ch. 15.

² *Ibid.*

There are few, we imagine, who would not prefer Corelli's version to that of Rameau.

So also with respect to his theory of chord generation by means of added Thirds, we read :—" The greater the number of Thirds in a chord, the greater is the variety of possible combinations of these Thirds ; as may be observed in the chord of the Seventh. *Experience permits us to place whatever Thirds we wish above one another*, provided that two major Thirds do not occur in succession : then the chord of the Seventh admits of the following five different combinations :—



All these are chords of the Seventh, although the order of Thirds differs in each." ¹ Comment here is needless !

NATURE AND ORIGIN OF TONE-SYSTEMS.

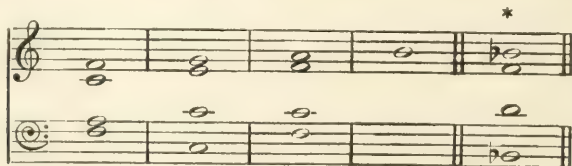
In the ninth chapter of the *Nouveau Système* (*De la Mélodie naturelle*) Rameau attempts to demonstrate that melody is natural to us. This, he thinks, can be proved by a simple experiment. " Take any one," he says, " destitute of musical knowledge or experience, it is almost certain that the first sound he sings will be regarded by him as a Tonic, or at least as the Fifth above this Tonic. If the first sound be taken as Tonic, he will then ascend to the Fifth or Third of the Tonic harmony ; if however the first sound be regarded as Fifth, the notes of the Tonic harmony will be taken in descending ; all this will be done instinctively." The reason of which is, that " we cannot hear a sound without being at the same time affected by its harmony." It is soon apparent however that the singer in question is not so destitute of experience as Rameau imagines him to be. It appears that he knows something of the Fundamental Bass. " If this person sings indifferently the Fifth or the *Fourth* after the first sound [Tonic], remark that he follows here the progression of the fundamental sounds " ; also that he is acquainted with our modern major and minor scales, preferring the semitone

¹ *Nouveau Système*, p. 7.

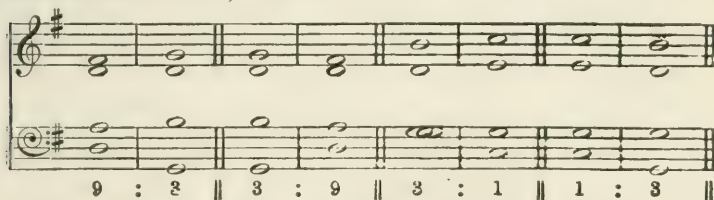
lying immediately below the Tonic (leading-note) to the whole-tone ; “ in singing a scale, this person will always sing the whole-tone above the Tonic, and most frequently the half-tone below . . . for the tone above the Tonic and the semitone below are nothing but the Fifth and major Third respectively of the Fifth of the Tonic : whereas the whole-tone below is the minor Third of its Fifth, which minor Third is less natural than the major.” Also “ he will prefer the major mode to the minor, because the major mode is the most natural.”

Rameau, however, does not tell us which of the old Modes on which the Church melodies were based he considers to be the most natural. He should also have mentioned the fact that our major and minor modes, of which alone he takes account, did not become *natural* to us until the end of the seventeenth and beginning of the eighteenth centuries. In the chapter which immediately follows (*Que nous trouvons naturellement la basse-fondamentale de tous les repos insérez dans un chant*) Rameau endeavours to show that harmony also is natural to us ; and even remarks that we naturally discover the Fundamental Bass appropriate to any given melody ; which, if it were really so in Rameau’s time, is certainly not true in the case of many students of harmony of our own day. All the same, it is not difficult to understand what it is that Rameau wishes us to infer—that melody, scales, harmony, etc., cannot have arisen arbitrarily, but must have had their source in some definite, even natural principle. This is his real meaning, and it is necessary to a very large extent to agree with him, even if he is unable fully to explain how such developments have been brought about.

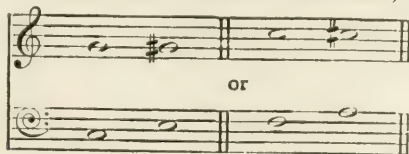
Rameau proceeds to raise questions of the greatest importance for the science of harmony. He remarks, for example, that “ it is difficult to sing three whole-tones in succession, because such a succession of sounds does not conform to the [natural] progression of the Fundamental bass ” :—



Here the Fundamental Bass cannot proceed further than the note *a*; if however a semitone be taken above this note, instead of a whole tone(*), the Fundamental Bass is at liberty to descend a Fifth; the succession of sounds, *f-g-a-b*, now becomes easy to sing. He also dwells on the importance of the *Cadences*, which arise from the progression of the sounds of this Fundamental Bass. "Even the most experienced musicians," he says, "must agree that the only Cadences which they can make use of—except the Interrupted Cadence, which however is derived from the Perfect Cadence—must always have as their real bass the fundamental sounds, thus :—



"If, then, the most consummate of musicians can do nothing other than what is dictated to us by the principle proposed . . . and if this principle is based solely on a single fact of experience, which proves to us that we cannot intone a sound without being at the same time affected by its harmony . . . this is unquestionably to presume that the different inflexions of our voice [in singing] arise from this principle, and that they are natural to us, since this principle is natural. We may go further, and say that not only are they natural to us, but that they alone are natural to us.¹ For if, in order to find greater variety, we add something to the progression by the Fifth, we can only add the progression by the Third. From this progression by the Third there will arise the Chromatic semitone, thus :—



¹ Rameau has evidently forgotten, for the time being, the existence of the minor harmony and the Minor Mode.

“Is it necessary to go further and try to discover smaller degrees than the chromatic and diatonic semitones? This would be against the natural order of things. For we must not forget that a single string furnishes us with three different sounds; that Harmony and its progression can result only from these three sounds, and that Melody is only a consequence of the progression of Harmony.

“If we abandon this principle, nothing will be easier than to imagine any kind of interval: than to appropriate these intervals to harmony, to its progression, even to the voice. If we deny this principle everything will be good; the Enharmonic Diesis which divides the semitone, the Comma which divides this Diesis, the semi-comma which divides this comma—in fact, everything that presents itself will be equally good. . . . It may be said that the degrees most natural to the voice are those which it can intone with the least difficulty; that we get accustomed to these degrees; but that if we were accustomed to others, these would appear equally natural. . . . But it is not to frequent use that we owe the inflexions which we remark as natural to the voice; custom, it is true, may render them more familiar to us, but if they were not natural, in vain would we force ourselves to sing them. Not even the most experienced musician, however flexible his voice, can accurately determine a quarter of a tone . . . because it is not natural to the voice, and the reason why it is not natural is, that one cannot understand the progression of the two fundamental sounds whose harmony furnishes to us this quarter of a tone. . . . The Greeks, it is true, had an Enharmonic system, in which this quarter-tone is found, but this system was with them only a theoretical system. By it they demonstrated the composition of certain intervals. We could, in much the same way, form an entire system from the commas which compose the whole-tone.”¹

¹ *Nouveau Système*, Ch. 9.

CHAPTER VI.

RAMEAU'S *GÉNÉRATION HARMONIQUE* AND *DÉMONSTRATION
DU PRINCIPE DE L'HARMONIE*.

IN the two important works which we have now to examine, the *Génération Harmonique*, 1737, and *Démonstration du Principe de l'Harmonie*, 1750, we may consider Rameau's views on the subject of harmonic science to be fully matured, and his theory of harmony completely developed.¹ The second work, which is smaller than the first, was presented by Rameau (December, 1749), in the form of a memoir or communication addressed to *Messieurs de l'Académie Royale des Sciences*, was "approved" by that learned body, and a report dealing with the main principles of Rameau's theory, drawn up and signed by three distinguished members of the Academy, MM. de Mairan, Nicole, and d'Alembert—a report which was subsequently appended by Rameau to his *Démonstration*—placed among the "registers" of the Academy.

In the *Génération Harmonique*, which is also inscribed to the members of the *Académie des Sciences*, we find that Rameau now considers harmony to be a physico-mathematical science, of sufficient scientific importance to merit the attention of the most eminent *savants* of his day. "Music," he remarks, "is for most people an art intended only for amusement; as respects artistic creation and the appreciation of artistic works, this is supposed to be only a question of *taste*; for you however Music is a Science, established on fixed principles, and which, while it pleases the ear, appeals also to the reason. Long before Music had attained its present degree of perfection, several *savants* had deemed it to be worthy of their attention and investigation, and almost since its origin it has had the

¹ See, however, his *Nouvelles Réflexions sur le Principe sonore* (p. 264).

honour of being regarded as a physico-mathematical science. One may say that it has this singular advantage, of presenting simultaneously to the mind and to the senses every conceivable proportion (*rapport*) by means of a vibrating sonorous body ; while in other departments of mathematics the mind is not usually helped by the senses in appreciating such proportions."

Since the publication of the *Nouveau Système*, Rameau has continued to investigate the nature of various acoustical phenomena, especially those relating to the resonance of a sounding body, which he considers to have a direct bearing on the science of harmony. In these investigations he appears to have had the assistance of two eminent French physicists, MM. de Mairan and de Gemaches. "It is ten or twelve years ago," he says, "since M. de Mairan, whose name alone commands respect, in the course of a conversation with regard to my system of harmony, communicated to me this idea concerning the particles of air. . . . But as at this time I had not given to the subject any great consideration, and besides did not perceive how I could derive any advantage from it, I had almost forgotten about it when M. de Gamaches recalled M. de Mairan's conversation to my memory, and had the kindness, for which I cannot sufficiently thank him, to point out to me the bearing it had on the principles on which my system is based." ¹

In the first chapter of the *Génération Harmonique*, Rameau brings forward a number of theses (*Propositions*), and observations relating to the physical properties of a sonorous body (*Expériences*), some of which, as Dr. Riemann (*Geschichte der Musiktheorie*) remarks, are calculated to make physicists and physiologists even of the present day raise their eyebrows in astonishment. Some of them foreshadow and may even be said to anticipate some of the discoveries in physical and physiological science which have been generally understood to belong to a later time. The fibres connected with the basilar membrane in the cochlea of the ear (*Fibres of Corti*) are referred to thus :—

XII^e. Proposition : "What has been said of sonorous bodies ought equally to be understood of the Fibres which line the base of the shell (*conque*) of the ear ; these fibres are so many sonorous bodies, to which the air communicates

¹ *Gén. Harm.*, Ch. I, Prop. III.

its vibrations, and by means of which the sensation of sound and of harmony is transmitted to the brain."

Some of the propositions touch closely on the question of the nature of consonance and dissonance. The power which two or more sounds may possess of blending together, or fusing into what appears to be a single sound, is shown to depend on the *degree of commensurability* existing between them.

V^e. Proposition: "A sonorous body set in motion communicates its vibrations not only to the particles of air capable of the same vibrations, but to all the other particles *commensurable to the first*."

VII^e. Proposition: "Those sounds are most commensurable which communicate their vibrations most easily and most powerfully; whence it follows that the effect of the greatest common measure between sonorous bodies which communicate their vibrations by the medium of the air ought to outweigh that of every other aliquot part, since this greatest common measure is the most commensurable."

X. Proposition: "The more nearly an aliquot part approaches to the ratio of equality, the more its resonance becomes united with that of the entire [sonorous] body; this is a fact of experience to be observed in the Unison, Octave, etc."

Of *beats* and their connection with the problem of consonance and dissonance, Rameau treats thus:—

V^e. Expérience: ". . . The air marks a harsh disagreement, dissonance [between two sounds] by the frequency and rapidity of the *beats* (*battements*) which arise; their consonance is marked by the cessation of these beats." Further: "The rapidity of the beats increases as the two sounds in question approach towards a state of consonance." This reads like a passage from Helmholtz's *Sensations of Tone*. Let it be observed, however, that Rameau does not discover in beats, or their absence, the *cause* or *explanation* of the phenomena of consonance and dissonance. He merely points to the connection existing between the two. On the contrary, Rameau explains consonance as resulting from the degree of commensurability existing between sounds. In this, some able physicists and acousticians of the present day¹ would consider that Rameau

¹ See Karl Stumpf's *Tonpsychologie* (1890) and *Über Konsonanz und Dissonanz* (1898).

shows himself to be more penetrating and more scientifically accurate than Helmholtz.¹

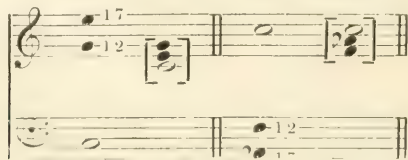
Concerning the sympathetic vibration of strings, we read :

II^e. Expérience : Take a Viola or 'Cello, and tune accurately two of its strings at the distance of a Twelfth from each other ; sound the lower string, and you will not only see the higher string vibrate, but you will hear it sound. . . . Set now the higher string in vibration, and you will not only observe the lower string to vibrate throughout its whole length, but also to divide itself into three equal parts, forming three segments (*ventres*) with two nodes or fixed points."

III^e. Expérience : " Sound one of the lower strings of the Viola or 'Cello, and you will hear, if you listen attentively, not only the fundamental sound, but also its Octave, double Octave, Twelfth and Seventeenth above [here Rameau is treating of upper partial tones] which are related to the fundamental sound in the following proportions, $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{8}$. The seventh harmonic, which has the proportion $\frac{1}{7}$, may also be distinguished—to say nothing of other sounds—but it is so faint that it is seldom noticed." In *Expérience IV^e*, reference is made to the " mixture stop " on the organ, as showing how sounds related to one another in the proportions $1, \frac{1}{3}, \frac{1}{5}$, may combine so as to produce the impression of a single sound.

By such *Expériences* Rameau demonstrates the essentially compound nature of musical sound. " It is harmonious, and its harmony produces the proportion $1, \frac{1}{3}, \frac{1}{5}$: which finds itself reproduced in the proportion $1, 3, 5$, by virtue of the power of sympathetic vibration." possessed by acute sounds on lower sounds which are commensurable to them. The proportion $1, \frac{1}{3}, \frac{1}{5}$ represents the *major* harmony, consisting of fundamental note, Twelfth, and (major) Seventeenth above ; the proportion $1, 3, 5$ represents the *minor* harmony, consisting of fundamental note, Twelfth, and (major) Seventeenth below :—

Major harmony. Minor harmony.



¹ See, however, pp. 383-385.

When the fundamental note is set in vibration, the Twelfth and Seventeenth above may be heard to sound along with it (major harmony) : at the same time the Twelfth and Seventeenth below, according to Rameau, are made to co-vibrate, although they are not heard to sound (minor harmony). But here Rameau finds himself confronted by a difficulty. For other harmonics than the Twelfth and Seventeenth above a fundamental note may be heard to sound along with it ; while also other sonorous bodies than those which correspond to the Twelfth and Seventeenth below are capable of being acted upon by the resonance of the fundamental sound. For example, in addition to the third and fifth upper partial tones (the Twelfth and Seventeenth above) or, as Rameau calls them, " harmonics," the *seventh* upper partial tone may frequently be quite clearly distinguished as a constituent of the compound tone of the fundamental sound. As Rameau himself points out, other sounds still higher in the harmonic series may also be distinguished. Why then should not at least this seventh harmonic, as well as the third and fifth, be included as an essential and constituent part of the harmony which Rameau considers to be generated from the resonance of the fundamental sound ? Rameau is aware of this difficulty, and attempts to remove it. He thinks that a musical sound, to be appreciated as such by the ear, should not contain more than the three sounds above mentioned ($1, \frac{1}{3}, \frac{1}{5}$), for where higher harmonics than these strike distinctly on the ear, the ear becomes confused, and is unable to appreciate any sound clearly. This may be proved, Rameau proceeds, by a very simple experiment.

VI^e. Expérience : " Suspend a pair of tongs by means of a thin piece of twine and apply to each ear an end of the twine. Now strike the tongs smartly, and nothing will be heard but a confused jumble of sounds, which will make it difficult for the ear to appreciate any one sound clearly. Soon however, the more acute of these sounds will begin to die away . . the lowest sound, that of the entire sonorous body, will then begin to make itself heard, sounding in the ear like one of the low tones of an organ. In addition, there may be heard along with this fundamental sound its harmonics of the Twelfth and Seventeenth major." It is also owing to the confusion of the ear produced by too

great a number of the higher harmonics that one is unable to appreciate clearly the lower sounds produced by the 16 and 32 feet pipes of the organ. These low tones however, although inappreciable by themselves, may be rendered appreciable by combining with them tones an Octave higher.¹ (*V^e. Expérience.*) But it is not only the presence of too great a number of these higher harmonics, but also their entire absence which, according to Rameau, renders musical sound as such inappreciable to the ear. Very acute sounds are also inappreciable by themselves. This is because, owing to the extreme smallness of the sonorous body producing such an acute sound, it is impossible for it to draw any harmonics from its aliquot parts. By combining however such a sound with its Octave below, the sound is rendered appreciable: this lower sound supplying the Octaves of the harmonics required.² "Hence," concludes Rameau, "musical sound is inappreciable without the help of the resonance of a certain fixed number of its aliquot parts." This number "is limited to the three different sounds which have the proportion 1, $\frac{1}{3}$, $\frac{1}{5}$. . . since without the resonance of $\frac{1}{3}$ and $\frac{1}{5}$, or at least one of the two, the sound is no longer appreciable by itself; and the same is the case if the sounds produced by the smaller aliquot parts strike on the ear too distinctly; everything then becomes confused."³

In these *Propositions* and *Expériences* Rameau is of opinion that he has at last found the means whereby he can give to his theoretical principles a firm and sure foundation. Thus in the *Préface* he begins: I have at last succeeded, if I do not deceive myself, in obtaining the proof of this principle of harmony, which had been suggested to me only by means of experience; this Fundamental Bass, the sole compass of the ear, the invisible guide of the musician, which he has unconsciously followed in his artistic productions, but which he has no sooner become acquainted with than

¹ Cf. Helmholtz: *Sensations of Tone*, Part II., Ch. 9.—"When we continually descend in the scale, the strength of our sensation decreases so rapidly that the sound of the prime tone, though its *vis-viva* is independently greater than that of its upper partials, as is shown in higher positions of a musical tone of the same composition, is overcome and concealed by its own upper partials."

² *Gén. Harm.*, "Conclusions," Ch. 1.

³ *Ibid.*

he has claimed it as his own. . . . Such a Fundamental Bass is indeed one of those natural sentiments which only reveal themselves to us clearly the moment we begin to think about them." So enamoured is Rameau of his new ideas, and of the physical properties of the sonorous body, that he does not hesitate to affirm, notwithstanding his express declaration to the contrary in the *Traité de l'harmonie*, that in his previous efforts he has been guided by "experience" alone, and that only now for the first time is he enabled to give to his principles a scientific foundation.

What then does Rameau affirm to be the net result of his acoustical researches? In the *Traité* he has sought for his theoretical principles a mathematical basis; in the *Génération Harmonique* his endeavour is to demonstrate that these principles are not only intimately connected with, but have their origin in the physical properties of the sonorous body itself. "We must regard harmony," he says, "as a *natural effect* resulting from the resonance of a sonorous body; it is from this that it derives its origin; musical sound as such is not in its nature simple, but harmonious, and its harmony produces the proportions 1, $\frac{1}{3}$, $\frac{1}{5}$, and 1:3:5. . . .; the proportion 1, $\frac{1}{3}$, $\frac{1}{5}$, is just what has always been known by the name of the *Trias Harmonica*, the *Harmonic Proportion*.¹ Here we find something new, of which we have already observed signs in the *Nouveau Système*. Rameau has, however, changed his standpoint. In his previous works he regards the major harmony—his principle of principles, upon which he has sought to build up a complete system—as resulting from the division of a sonorous body by the first six numbers, representing a certain fixed mathematical proportion; now this major harmony is shown to be a property inherent in the sonorous body itself; it is no longer considered to be the result of a mathematical proportion, but itself produces this proportion. This re-statement of the connection existing between harmony and mathematics or proportions, shows that Rameau has not completely succeeded in satisfying himself that his use of mathematics and, especially in the *Nouveau Système*, of proportions, is free from serious objection, as assuredly it is not. In the *Génération Harmonique* he expressly states

¹ *Gén. Harm.*, "Conclusions," Ch. I.

that he has endeavoured, in the course of that work, to avoid a too arbitrary use of such proportions.¹

The position which Rameau takes up in his *Expériences* is quite clear and definite. He makes everything depend on the "appreciability," as he calls it, or "non-appreciability" of musical or *quasi*-musical sounds. He endeavours to demonstrate that a musical sound, to be appreciable as such, as well as in respect of its pitch relationship, must consist of neither more nor less than the three sounds of the fundamental tone, with its third or fifth upper partial tones (the second and fourth upper partials being considered as replicas of the fundamental tone). All other sounds are non-appreciable as musical sounds. Such is Rameau's argument, which has at least the merit of being extremely ingenious. But Rameau, his ingenuity notwithstanding, cannot dispose of the matter in this way. He makes an observation relating to the physical nature of a vibrating sonorous body, which has the fatal defect of being demonstrably inaccurate, indeed false. A very large number of musical sounds which *are* appreciable, both as such, and in respect of their pitch relationship, contain more upper partials than those of the Third and Fifth; such are the musical tones of the voice, those of the organ and pianoforte, the majority of orchestral instruments, etc., indeed, as Helmholtz has informed us,² nearly all sounds which are useful for musical purposes.

This question of the appreciability of musical sounds appears to have been brought forward by Rameau with the object also of getting rid of a difficulty of which he is quite aware, namely, that the natural series of upper partial tones arising from the resonance of a vibrating sonorous body is

¹ " Nous ne sommes point conduits en conséquence de cette proportion [i.e. $1, \frac{1}{3}, \frac{1}{5}$, or $1 : 3 : 5$] nous avons feint de l'ignorer, & nous avons attendu que la nature même des corps sonores nous la rendit, pour être convaincus par nous-même qu'elle est effectivement l'unique arbitre de l'harmonie." [*Gén. Harm.*, "Conclusions," Ch. i.] " La proportion harmonique peut bien être regardée comme un principe en musique, mais non pas comme le premier de tous : elle n'y existe qu'à la faveur des differens sons qu'on distingue dans la résonance d'un corps sonore. . . . Se servir à propos des proportions, même des progressions, les appliquer à leur objet, rien n'est mieux : mais vouloir en tirer leur principe même, et ses dependances, c'est s'exposer infailliblement à l'erreur." (*Gén. Harm.*, Preface.)

² *Sensations of Tone.* Part II., Ch. 10.

not limited to the first five or six of such tones. (See his remarks on the *natural* sounds of the trumpet, *Gén. Harm.*, Ch. 6, Art. 4.) It is necessary for his purpose to admit 1, $\frac{1}{3}$, $\frac{1}{5}$, for these produce the major harmony, but it is necessary to exclude the $\frac{1}{7}$. Rameau's reasons for excluding this $\frac{1}{7}$ are not convincing. In many musical sounds this $\frac{1}{7}$ is distinctly audible, nevertheless the compound tone of which it forms a part is beyond question quite appreciable, both with regard to pitch and character. Another reason brought forward by Rameau for the exclusion of the $\frac{1}{7}$ is that *it is not in tune!* Speaking of instruments, such as the trumpet, capable of producing the natural series of harmonics, he says: "The sounds of the $\frac{1}{7}$, $\frac{1}{11}$ and $\frac{1}{13}$, being harmonic neither of 1 nor of 3, are always false in these instruments." And yet Rameau's lifelong task, his task even at the moment when he is describing the natural Seventh as false, and out of tune, is that of endeavouring to prove that we receive harmony directly from Nature!

It would indeed appear as if the net result of Rameau's digression into the realm of physical science was to make matters rather worse than they were before. For the arithmetical division of the monochord, which forms his starting point in the *Traité*, he now substitutes the natural division of the sonorous body. He may argue, with reason, that in the senary division of the monochord, as he finds it explained by Zarlino, and in the lucid theorem of Descartes, we discover the principle and origin of harmony, in the sense that it supplies us with all the consonances. But unfortunately for Rameau the natural division of the sonorous body does not stop where he wants it to stop. Rameau would place his finger on the number 6, and would say to Nature: "Thus far, but no further!" He will have nothing to do with any harmonics beyond this number. Further, he has a grievance against Nature—the very first of such harmonics is out of tune.

In the *Traité*, Rameau is of opinion that the minor harmony arises from the same principle as the major, and altogether and emphatically rejects Zarlino's explanation of the minor harmony as arising from the Arithmetical proportion. In the *Génération Harmonique* he abandons his former views respecting the nature and origin of this harmony. He now sees clearly

that while the first harmonic sounds resulting from the resonance of the sonorous body may be considered to constitute the major harmony, such an order or arrangement of sounds can never constitute a minor one. That is, the harmony "we receive directly from Nature" is always major, and can never be minor. He therefore now relates the minor harmony to another principle, namely, the sympathetic vibration of strings,¹ and to the arithmetical proportion; that is, he accepts Zarlino's explanation of it. At the same time he claims to have discovered for the minor harmony its real physical basis. "Those who like ourselves," he remarks, "have made use of the Arithmetical Proportion have done so only for the sake of convenience, and without a harmonic foundation."² This new and extremely important feature of Rameau's theory will be fully discussed later.

OBJECTIONS TO RAMEAU'S THEORIES.

In thus claiming for harmony a physical basis, and in making the science of harmony to depend on the physical properties of musical sound itself, Rameau has found many adherents and imitators. At the same time, his methods in this respect have met with severe criticism,³ and it may be as well, before proceeding further, to examine to what extent such criticism actually affects Rameau's position as a theorist.

Berlioz, in an analysis which he has made of Rameau's theory of harmony,⁴ raises objections of a kind which has found voice in many quarters, and at ever-recurring intervals even up to the present day.—He says:—"The whole system of Rameau is based on a natural fact which he had very badly observed, as one will see, namely the harmonic resonance of the sonorous body." . . . "He speaks incessantly of the resonance of such a body, which is for him a stretched

¹ See p. 219

² See p. 80.

³ Ed. Fétis.—*Esquisse de l'histoire de l'harmonie; Traité complet de la théorie et de la pratique de l'harmonie*. Kirnberger.—*Kunst des reinen Satzes (die wahren Grundsätze zum Gebrauch der Harmonie)*. Hauptmann.—*Die Natur der Harmonik und der Metrik*, etc.

⁴ *De Rameau et quelques uns de ses ouvrages*. (*Gazette Musicale*, Paris, 1842.)

string or an organ pipe. But he seems to believe that the resonance of all other sonorous bodies gives the same results, which is false. On the contrary, there are those which give only frightful discordances, which nevertheless can be called their harmonics, and which owe their existence to the same law as sounds called harmonic and musical. Why then are all these sonorous bodies disinherited in favour of the stretched string and the organ pipe? They also are in Nature." . . . "It is astonishing to hear at the present day such expressions as 'this is beautiful, because it is in Nature!' Nothing could be more absurd! There is really nothing which is not in Nature. Vocal music is in Nature, because it is Nature that produces the voice. In this case, let us include the cries of animals: these are as natural as the accents of the human voice. Instrumental music, then, is not natural, because Nature does not make instruments!

"Since Rameau admits dissonances, although they are not natural . . . what then does it matter that the harmonic resonance of a string gives the perfect chord? . . . But here Rameau appears to be ignorant of a fact which is of favourable import for his theory. For in the string and organ pipe may be observed the natural production of dissonance! He believes that they produce only the Fifth and Third, when manifestly they produce also the minor Seventh and major Ninth, and several other harsh dissonances arranged diatonically. . . . Again, he goes to extraordinary lengths in order to naturalize the Minor Mode. O unfortunate Rameau! not to have noticed that the majority of large bells make us hear quite distinctly the minor Third above its fundamental tone! How this fact would have consolidated his theory! . . . Here is a musician . . . who pretends to derive harmony from a natural phenomenon, and yet who does not know the real power which this phenomenon has in affecting, in a favourable way, his theory; and who, if he knew it in its entirety, would be forced to admit combinations as harmonious which are really insupportable, or to avow that musical harmony is the result of a *choice* of sounds, according to the different impressions that they make on our ear in such and such combinations, with particular conditions as to their successive connection, and to recognize finally that the science of chords has no other *raison d'être* than that of our organization,

and no other basis than that which he denies to it, namely, *Experience*.”¹

More restrained in language, as well as more accurate in statement, are the observations of Helmholtz. He says:—“In the middle of last century, when much suffering arose from an artificial social condition, it might have been enough to show that a thing was *natural*, in order at the same time to prove that it must be *also* beautiful and desirable. Of course no one who considers (for example) the great perfection and suitability of all organic arrangements in the human body would, even at the present day, deny that when the existence of such natural relations has been proved as Rameau discovered between the tones of the major triad, they ought to be most carefully considered, at least as starting points for further research. And Rameau had indeed quite correctly conjectured, as we can now perceive, that *this fact was the proper basis of a theory of harmony*. But that is by no means everything. For in nature we find not only beauty but ugliness; not only help, but hurt. Hence the mere proof that anything is *natural*, does not suffice to justify it æsthetically. Moreover, if Rameau had listened to the effects of striking rods, bells, and membranes, or blowing over hollow chambers, he might have heard many a perfectly dissonant chord, quite unlike those obtained from strings and musical instruments. And yet such chords² cannot but be considered equally natural.”³

¹ It would seem that the article by Berlioz from which the above is taken, and which appeared in the *Parisian Revue et Gazette Musicale*, of which Fétis was editor, was to a large extent inspired by Fétis himself, who, in previous numbers of the periodical, had devoted some space to an examination of Rameau's theory of harmony. The expressions used by Berlioz are in many respects similar to those used by Fétis. Further, Berlioz makes use of the term first coined by Fétis to describe the inner relationship existing between sounds and chords, namely, the term *Tonality*; and he in effect accepts the views of Fétis as to what constitutes the real basis of the theory of harmony. Thus he remarks: “The great law of *Tonality*, which appears to dominate all our harmonic edifice, has attracted Rameau's attention very little; he ignores it even in cases where it manifests itself most clearly.” But it is not at all clear that Berlioz had himself grasped the essential points of Rameau's theory.

² More correctly, *discords*, or *dissonances*.

³ *Sensations of Tone*, Part II., Ch. 12.

Rameau was, however, quite well aware that there were sonorous bodies which produced what Berlioz calls "frightful discordances." He had himself, as we have seen, examined such bodies and had rejected them, not because their resonance was not "natural," but because they produced not musical sound but a "jumble of sounds."

Rameau might quite well have inquired what reasonable prospect existed of discovering the source of harmony in sonorous bodies which were capable of producing only "frightful discordances," otherwise noise, and might quite well have considered that it was time enough to base a theory of harmony on the phenomena presented by the resonance of such bodies, when it had become the prevailing custom among composers to write artistic works for an orchestra composed of "striking rods" and "hollow chambers." But we have not yet arrived at this stage of symphonic development.

Nevertheless, it is clear that Rameau is unable to make harmonic resonance the basis of a theory of harmony on the ground that such resonance is "natural." When he speaks, as he frequently does, of harmony being "a natural effect," he does not appear to make use of the term in any specific or restricted sense. But as Helmholtz points out, the mere fact of a thing being natural does not suffice to justify it æsthetically.

Rameau's standpoint with regard to the problem of Consonance is better and more correctly appreciated by E. F. F. Chladni (1756-1827), well known as one of the most eminent acousticians of his time, and who in various works has given the result of his researches and experiments in connection with many different kinds of sounding bodies. Chladni does not agree with Rameau's explanation of consonance or of harmony. Rameau, he considers, was led astray through ignorance of the laws of vibration of sonorous bodies, and by his belief that the resonance of all such bodies gave similar results, that is, that the partial tones in every case arose in the same order as those of a string. There is no doubt that such was Rameau's opinion.

Chladni says: "Many theorists, for example Rameau and his adherents, have thought that the principle of consonance and dissonance, and indeed of harmony in general, was to be found in the presence—or absence—of higher partial

tones which arose, corresponding to the natural series of numbers, from a prime or ground tone, this ground tone being regarded as unity. They have even gone so far as to imagine that the presence of such higher tones constituted the chief difference between musical sound and noise. The origin of such an error lies in the fact that in a string there is nothing to prevent its aliquot parts as well as the string as a whole from vibrating, and because, mainly through ignorance of the laws of vibration of other sonorous bodies, they have supposed that the order of partial tones produced by such bodies must be the same as that of a string. On the contrary, many other sonorous bodies, as rods, discs, bells, etc., produce quite a different order of partial tones. (In bells, circular vessels, etc., of uniform thickness, the proportions of the partial tones which result from their resonance are as the squares of the numbers 2, 3, 4, 5, etc., or, if we regard the lowest tone as unity, as 1, $2\frac{1}{4}$, 4, $6\frac{1}{4}$, etc.).

"It is evident, therefore that consonance and dissonance cannot be explained in this way. The attempt to do so leads to many absurd consequences; for example, in a harmonic bell (*Harmonika-glocke*) the Ninth 4:9 is the first consonance!"¹

It will be perceived that Chladni does not, like Helmholtz, make the whole question turn on Rameau's use of the word "natural." Altogether apart from the meaning which may be attached to this term, Chladni considers that the facts are against Rameau.² It is true that Helmholtz points to the inharmonic partial tones, the dissonances, which result from the natural resonance of such bodies as striking rods. But it can hardly be supposed that Helmholtz means, like Chladni, to advance this as a proof of the impossibility, the absurdity, of claiming harmonic resonance as the real principle of harmony. On the contrary, it is important to note, Helmholtz supports Rameau's view, and considers that he was right in his conjecture that in harmonic resonance we discover the proper basis of the theory of harmony. In referring as he does to the "dissonant chords" produced by

¹ *Kurze Uebersicht der Schall- und Klanglehre, nebst einem Anhang die Entwicklung und Anordnung der Tonverhältnisse betreffend* (1827).

² It should be noted, however, that Chladni explains consonance as due to the simplicity, or comparative simplicity, of the ratio which determines it (1:2; 2:3, 3:4, etc.).

such bodies as striking rods, Helmholtz therefore can only mean to indicate that the mere fact of their being "natural" does not suffice to justify them æsthetically. Rameau to be sure never evinced any desire to justify them æsthetically; nor has any theorist of repute since his time shown any great eagerness to accept them or to give them a place in the theory of harmony. The difficulty, indeed, with many of the theorists who have made acoustical phenomena the basis of harmonic science and of "natural discords" has been, and still is, not so much to discover a reason for accepting the "natural discords" of which Helmholtz speaks, as to discover a reason for rejecting them; for if, as Helmholtz points out, we find in Nature not only help but hurt, it must be remembered that in music we find not only concord but discord. In this respect at least music holds the mirror up to Nature.

As is known, Helmholtz considers the effect of dissonance to be due to the phenomena of *beats*, that is, rapid pulsations arising from the alternate reinforcement and enfeeblement of sound. These beats interrupt the steady uniform flow of the sound, and produce an intermittent effect on the ear, corresponding to the effect produced by a flickering light on the eye. The effect of such sensations is unpleasant, and this unpleasantness of effect is owing to the intermittent excitement such sensations produce in the nerves of hearing and of sight. The physical or physiological explanation of dissonance, therefore, is to be found in the jolting or jarring of the auditory nerve by means of beats. On the other hand, consonance is distinguished by the absence of beats. The tones which form a consonance co-exist undisturbed in the ear, and there is nothing to interrupt the smooth, continuous flow of sound. This is the physical explanation of consonance.¹

In order that two or more sounds, when heard simultaneously, should affect the ear with the sensation of consonance, it is necessary that they form with one another perfectly definite intervals. But the proportions which exactly determine such intervals are found in the natural relations which may be observed to exist in the resonance of sounding bodies such as a stretched string or organ

¹ See also pp. 383-385.

pipe. Such natural relations, then, may be said to constitute the proper basis of a theory of harmony, not because they are natural, but because they determine the consonances.¹

Is Helmholtz able, then, by means of his theory of Consonance as resulting from the absence of beats, to draw an effective distinction between intervals which are consonant and those which are dissonant, a distinction which is necessary in music, and one which is made by every musician? The relative degrees of "harmoniousness" or consonance pertaining to the various consonant intervals Helmholtz illustrates by means of the following table:—

1. Octave	..	..	..	1 : 2
2. Twelfth	..	..	..	1 : 3
3. Fifth	..	..	..	2 : 3
4. Fourth	..	..	..	3 : 4
5. Major Sixth	..	..	..	3 : 5
6. Major Third	..	..	..	4 : 5
7. Minor Third	..	..	..	5 : 6

Of these consonant intervals, the Octave and Twelfth are the smoothest in effect. On the other hand, the major and minor Thirds exhibit a decided roughness of character, this roughness being due to the presence of beats arising between the upper partial tones of the two sounds forming the interval. What, then, of the minor Sixth? This interval Helmholtz finds to be so rough, indeed dissonant in character, that he is unable to explain it as a consonance, which no doubt accounts for its exclusion from his table of consonant intervals. Indeed the minor Sixth, it appears, is frequently less consonant than the "natural" Seventh, 4 : 7. "The sub-minor Seventh 4 : 7," Helmholtz remarks, "is very often more harmonious than the minor Sixth 5 : 8; in fact, it is always so when the third partial tone of the note is strong compared with the second, because then the Fifth has a more powerfully disturbing effect on the intervals distant from it by a Semitone, than the Octave or the sub-minor Seventh, which is rather more than a whole-tone removed from it."² Later in his work, however, Helmholtz is of opinion that this "natural" Seventh is sufficiently dissonant to

¹ *Sensations of Tone*, Pt. II., Ch. II.

² *Ibid.*, Ch. IO.

form the Seventh of the chord of the Dominant Seventh.¹ Finally, he tells us that the reason why this sub-minor Seventh is not used as a consonance in music is because "when combined with the other consonances in chords it produces intervals which are all worse than itself."²

Helmholtz however is quite well aware that the minor Sixth is actually employed in music as a consonance. This, he thinks, can only be explained by the fact that the minor Sixth is the inversion of the major Third. But in this case what becomes of the "jarring of the auditory nerve" produced by the beats which so distinctly characterize the minor Sixth? Are these beats no longer present? On the other hand we find that the Fourth is a better consonance than the major Third, and that it is unnecessary to explain its consonant character as arising from the principle of inversion. But unfortunately for Helmholtz's theory, this Fourth, ever since within one or two centuries of the first rude beginnings of harmonic music, has been consistently treated by musicians as a dissonance, *except* when it represented the inversion of the Fifth, and this apart from any question of modulation, key, or tonal order. It is unnecessary to dwell here on the unsatisfactory results obtained by Helmholtz in treating of the consonance of the minor harmony. Only one other point need be noticed. From the table given above it appears that the Fourth and major Sixth are superior, as consonances, to the major and minor Thirds. It follows therefore that the $\frac{6}{4}$ position of the major harmony is in effect not only more consonant than the minor harmony in fundamental position, but more consonant than the fundamental position of the major harmony itself, and this apart from any question as to the "tonal function" of the chord. It is scarcely credible that Helmholtz should attempt to vindicate this extraordinary result of his theory. Nevertheless we read: "For just intervals the Thirds and Sixths decidedly disturb the general harmoniousness more than the Fourths, and hence the major chords of the Fourth and Sixth are more harmonious than those in the fundamental position."³

Helmholtz concludes his researches into the nature of consonance and dissonance with the remark that it is impossible

¹ *Sensations of Tone*, Part III., Ch. 17. ² *Ibid.*, Part II., Ch. 10.

³ *Ibid.*, Ch. 12.

to draw any sharp line between the two, and that the distinction between consonant and dissonant intervals "does not depend on the nature of the intervals themselves, but on the construction of the whole tonal system"!¹—It cannot be denied that a close connection exists between beats and the phenomenon of consonance: even the most experienced tuner has daily reason to be profoundly grateful to Nature for the assistance she renders him in the practical work of "tuning." Nevertheless, it can scarcely be maintained that Helmholtz provides us with an adequate solution of the problem of Consonance.

The conclusions arrived at by Helmholtz in his investigations concerning the nature of scales, tone-systems, consonance and dissonance, and of harmony in general, have been regarded in many quarters as authoritative and final. They have, however, by no means met with universal acceptance. On the contrary many of them, and especially within recent years, have met with a vigorous opposition from musical theorists and psychologists. It is in great part owing to the unsatisfactory nature and inadequacy of the theoretical results arrived at by Helmholtz in dealing with some of the most fundamental problems of harmonic science that many have concluded that the construction of any rational theory of harmony on the basis of acoustical phenomena is an impossibility.

Thus Dr. Riemann is of opinion that this reaction against acoustical theory represents a decided gain for the theory of harmony: ² while speaking of the difficulties presented by the minor harmony, he remarks:—"The principle of 'klang-representation' (*Klang-Vertretung*) has really to do not with physical science, nor with physiology, but with *Psychology*. If it is a fact of experience that we are able to understand a tone as the representative of a minor, as well as of a major chord. . . . then this is a scientific fact, which forms as good a foundation to build upon as acoustical phenomena. Once this fact has been thoroughly established and understood, we need not concern ourselves further with the physical basis of the minor harmony."³

¹ *Sensations of Tone*, Part, II. Ch. 12.

² *Geschichte der Musiktheorie*, p. 502.

³ *Die Natur der Harmonik*, p. 29.

But it is Fétis who is the most vigorous and uncompromising exponent of the doctrine that all harmony, scales, tone-systems, etc., have not a physical but a psychological basis. In the preface to his *Traité de l'harmonie* (1844), Fétis tells us that he had made the subject of harmony a life-long study, and that before venturing to publish the treatise in question, he had, in the course of twenty years, read and studied no fewer than 800 works dealing with the subject, as well as analysed musical compositions of every epoch. Fétis is well aware of the reach of his subject, and during these twenty years the Pythagorean notion of a universal harmony, of the "harmony of the spheres," seems to have taken up not a little of his attention. "These ideas," Fétis remarks, "concerning music, this primordial art which alone of all the arts has been accounted worthy of a divine origin, we find again with certain modifications in different parts of the Orient; one principal idea however runs through the centuries, namely, that of a harmony which rules and directs the movements of the heavenly bodies, and of which the music of men is but an imperfect imitation. The Hebrews borrowed the notion from the Chaldæans and the Sadducees who, attentive observers of the course of the stars, attributed to them an influence direct, supreme, and eternal on the whole of the universe. This led the Hebrews to the conception of particular intelligences, the *Angels*, who presided over the harmony of the stars, and whose songs, in which they praise and glorify the Eternal Being, are formed by the motions of the celestial spheres. . . . It is this same idea of a power, inferior to that of the Creator of the universe, but which gives life and movement to his work, which Pythagoras borrowed from the peoples of the Orient, the idea of a universal harmony. To Pythagoras it is the soul of the world, and he attributes to it harmonic proportions with which Plato makes us acquainted in a somewhat obscure passage of his *Timæus*, and which are those of the musical scale of the Greeks. . . . The notion of a universal harmony did not stop here; propagated from century to century, accepted and modified by the school of Alexandria, reproduced in the writings of Plutarch, of Cicero, Ptolemy, and many others, it again emerges after the Renaissance in the works of Plato's commentators, and ends by leading astray the powerful intellect of Kepler, just at the time

this learned man had discovered the fundamental laws of astronomy.”¹

Helmholtz also refers to this subject, and adds that “even in the most recent times natural philosophers may still be found who prefer such dreaming to scientific work.”² For Helmholtz there is no mystery whatever. “The enigma,” he remarks, “which 2,500 years ago Pythagoras proposed to science—‘Why is consonance determined by the ratios of small whole numbers?’—*has been solved* by the discovery that the ear resolves all complex sounds into pendular oscillations, according to the laws of sympathetic vibration. Mathematically expressed, this is done by Fourier’s law, which shows how any periodically variable magnitude, whatever be its nature, can be expressed by a sum of the simplest periodic magnitudes. The length of the periods of the simply periodic terms of this sum must be exactly such, that either 1, 2, 3, or 4, etc., of their periods are equal to the period of the given magnitude. This, reduced to tones, means that the vibrational numbers of the partial tones must be exactly once, twice, three times, four times, and so on, respectively as great as that of the prime tone. Ultimately, then, the reason of the rational numerical relations of Pythagoras is to be found in the theorem of Fourier, and in one sense this theorem may be considered as the prime source of the theory of harmony.”³ It should be noted that when Helmholtz speaks of vibrational numbers corresponding to the terms 1, 2, 3, 4, etc., he means, of course, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and so on *ad infinitum*. In this series we find the terms 9 and 15, whose vibrational numbers are exactly nine and fifteen times respectively as great as that of the prime tone. The first represents a major Ninth or major Second; the second represents a major Seventh. Are these intervals consonant, seeing that they are comprehended in Fourier’s law; and is Helmholtz here presenting us with a new theory of Consonance? On the contrary, as Helmholtz knows well, they are dissonant; and indeed, if the terms of the harmonic series be extended much further, we meet with as large and varied an assemblage of dissonances as the ear could well conceive of. It is difficult to believe that

¹ *Traité de l'harmonie*. Preface.

² *Sensations of Tone*, Part II., Ch. 12.

³ *Ibid.*

Helmholtz really succeeded in satisfying himself that we have here the solution of the problem of Consonance, or of the enigma proposed by Pythagoras.

It is evident that Fétis is not much enamoured of the idea of a "harmony of the spheres," of a "harmony of nature." It is, no doubt, a grand and sublime conception. Perhaps the morning stars sing together, and perhaps there is an ear to hear their music. But this, he thinks, has nothing to do with the theory of harmony. It may be good poetry, but it is bad science. What, he asks, in such a case, becomes of human liberty and free-will? "Let it be supposed that nature has determined a fixed and invariable order of sounds, and that man is conscious of this immutable order, it would be necessary to admit that any variety in the character of music and of harmony is impossible, and that the impressions produced by the combinations of these sounds ought to be identical in the case of all individuals gifted with the organ of hearing."¹

What then is the actual basis of music, of harmony? It is, Fétis answers, the *scale*: and, in the tonal relationships of the notes of the scale, in a word, in *Tonality*, we find the source and explanation of harmony, of harmonic relationship, and harmonic succession. Scales are, however, by no means a product of nature. Nature does not make scales; she only supplies the raw material, as it were, from which scales may be formed. "If it be asked," says Fétis, "what is the principle of these scales, and what determines the order of their sounds, if it be not acoustical phenomena, and the laws of calculation, I reply that this principle is purely metaphysical, and that such an order, and the melodic and harmonic phenomena to which it gives rise, are conceived by us as the necessary consequence of our conformation and our education. It is something which exists for us by itself, and independently of every cause outside ourselves. . . .

"Nevertheless, we seek in acoustical phenomena for the explanation of a tonal order, of a tonality, which lies ready to our hand! It is necessary to point out that these acoustical phenomena, badly understood as they often are, have not the significance that one so carelessly attributes to them. For example, the major harmony, which has been observed

¹ *Traité de l'harmonie*, Préface.

to result from the resonance of certain sonorous bodies, is accompanied by other more feeble sounds. It is the same in the case of other sonorous bodies which produce other harmonies. Besides, it has been proved that one and the same body is capable of different modes of vibration, giving rise to diverse phenomena. It has been demonstrated, for example, that the interval of the tritone discovered in the resonance of a square metal plate is the result of the vibration of the plate in the direction of its diagonal; whereas other forms of vibration of the plate give rise to other phenomena. Let it be supposed that in course of time we discover acoustical phenomena which furnish us with all the harmonies possible in our system; must we conclude that these unknown phenomena are the origin of the harmonies discovered *a priori* by the great composers? Truly this would be a rude blow dealt at our philosophic liberty; a somewhat perverse application of the doctrine advanced by certain sophists of the influence of occult causes on the determinations of the human will.”¹

The case against Rameau certainly appears to be a strong one. How, asks Berlioz in effect, are we really able to distinguish between consonance and dissonance, and what means do we have of discriminating between sonorous bodies which produce concord, and those which produce only discord? Is not the ear the sole judge? If not, what other means do we have? There is no other. Such being the case, why then not admit that “harmony is the result of a *choice* of sounds, according to the different impressions that they make on our ear”? To this Rameau might have replied that even if it be granted that the ear is the sole means we possess of distinguishing between consonance and dissonance, it does not necessarily follow that it is *free to choose the intervals it may apprehend as consonant*, and which constitute harmony, nor does it follow that, in the words of Fétis, “harmony is something which exists for us by itself, and independently of every cause outside ourselves.”

The question has another aspect. In all ages, as Fétis himself points out, men have thought that they discerned in music a faint echo, as it were, of some far-off celestial harmony, and have regarded it not merely as a mode of

¹ *Esquisse de l'histoire de l'harmonie.*

expression of the human soul, but, like Beethoven, as connecting in some mystical way the individual soul with the great universal Over-soul. They have gone even further, and have considered music to be essentially related to that mysterious power which guides the stars in their courses. But all this according to Fétis is a delusion: vain outpourings of childish or over-heated imaginations; sentiments which, at the best, are mere mysticism, incapable of clear definition, or of being expressed in scientific language. The music of man has nothing to do with any pretended "harmony of nature," or "music of the spheres." All music, harmonic or melodic, has its origin in scales; but scales are man-made: nature makes no scales. Why waste time in the attempt to identify the fundamental principles of harmony with the constitution and course of nature? It is a mere idle dream, unworthy of the scientist and the philosopher. Man cannot reach the stars! He may long, like Goethe, after the infinite soul of Nature, but he cannot grasp it!

It is evident that, on the hypothesis of Fétis, we are confronted not only with a serious theoretical, but by a no less serious æsthetical difficulty.

Rameau strives to identify music, to some extent at least, with reality, with objective truth. Fétis, on the other hand, can offer no reason whatever why music should not be considered merely as a play of sensations, the mere chance occasion of a passing pleasure. There are many, it is true, whose philosophy does not forbid such a view. Such a philosophy at least, we are told, does not go beyond the facts so far as these are known to us; in any case, there is much in it calculated to soothe and restrain the too ardent spirit. Why need we on this account, it is asked, compare the charming art of music to "a tale told by an idiot, mere sound and fury, signifying nothing"? Is the delight we find in music nothing in itself? Is it nothing that music, with its soothing influence, should help us to bear with greater equanimity the ills of life? May we not even reverence those gifted men who, out of their genius, have created for us such beautiful phantasies? But if this is the conclusion at which we must arrive, it is a sorry conclusion. It means, at least ultimately, the certain degradation of music. Music becomes a mere titillation of the æsthetic palate, a pleasure which of course, at least at first, should be regarded as being a little higher in the scale

than that to be derived from eating and drinking. But soon even this place of honour is lost, and music, which early Christianity considered to be the handmaid of religion becomes, as among the degenerate Greeks and Romans, a means for enhancing the pleasures of the table. Such a philosophy no doubt is not much disturbed by "idle dreams." This, however, is only what might be expected. No dreams, idle or otherwise, disturb the placidity of artistic death.

One may here refer in passing to the opinion expressed by certain philosophers of the present day, that if music has as Rameau claims for it its source in Nature, then all music becomes but the chance occasion of a passing pleasure, and the creative artist merely a kind of æsthetic cook. The considerations we have just advanced would go to prove that exactly the opposite was the case. But we have here, probably, nothing more than a misunderstanding, due to some confusion of ideas.

It is unnecessary to enter at present into an examination of the theory of harmony which Fétis has propounded in his *Traité*. Only one other point need be discussed here. Let it be assumed that we are in complete agreement with Fétis and Berlioz in their contention that harmony has nothing to do with acoustical phenomena, but that its principle is purely psychological, and that, in the full enjoyment and exercise of our "philosophic liberty," we select those sound-combinations which impress us as being harmonious or consonant. Let us take those intervals which from the earliest times, and among all peoples who have possessed any developed tone-system, have been regarded as consonances, namely, the Octave, Fifth, and Fourth. We find, however, as did Pythagoras in the sixth century B.C., that these consonances which have been undoubtedly selected by man in the free exercise of his genius, or at least without any conscious dependence on mathematical law, are all expressed by means of the proportions $1:2:3:4$. Not only so, they arise according to a quite definite mathematical principle, which determines their respective degrees of perfection (Octave = $1:2$, Fifth = $2:3$, Fourth = $3:4$). Such a fact might well cause Fétis to rub his eyes, and ask himself whether some "occult influence" had not indeed been at work here.

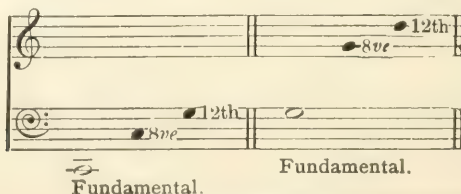
Further this mathematical principle accords not only with the order of these consonances, but with the historical development of harmony, in which first the Octave was used, as in the *magadizing* of the Greeks, and many centuries later, the Fifth and Fourth, as in the ecclesiastical *organum*. These consonances constituted the basis of the whole system of ecclesiastical modes, Authentic and Plagal. By the time of Zarlino, and indeed much earlier, the "natural" Thirds determined by the ratios 4:5:6, had been apprehended as consonant. Accordingly we find Zarlino drawing a new distinction between the modes, and classifying them as major or minor according to the nature of the Third which appeared above the Final. As we shall see more clearly later on, the introduction of the "natural" Thirds led in great measure to the ultimate overthrow of the old modes, to the emergence of our two modes of major and minor, and, consequently, startling as the statement may appear, to the gradual decay of an old artistic world, and the rise of a new period of harmonic music. Rameau, then, would seem to have some ground for his belief that *harmony is "not arbitrary, but arises from a definite principle."*

As to the manner in which this principle has influenced the course of harmonic development, there is nothing "occult" whatever. Descartes had already remarked that we hardly ever hear a musical sound without at the same time hearing its Octave. This Octave, indeed, forms part of the resonance of the fundamental sound. But what is true of the Octave is true also of the Fifth and Fourth, as well as of the natural Thirds. As Helmholtz himself informs us, all sounds suitable for musical purposes are richly endowed with upper partial tones.¹ In every musical sound, then, produced by the human voice, these consonances were to be heard, sounding now faintly, now powerfully, but ever present to the sensitive and attentive ear. First the Octave, Fifth and Fourth (1:2:3:4) were apprehended, and later the natural Thirds (4:5:6). Rameau therefore might well claim, not only that "harmony arises from a definite principle," but that "*this principle resides in musical sound itself.*" But these are, in fact, the main points for which Rameau has all along been contending.

¹ *Sensations of Tone*, Part II., Ch. 10.

What, then, of the seventh upper partial tone, the "natural Seventh," which may also be distinguished, though with greater difficulty, in the resonance of musical sound? Is it consonant, or is it dissonant? But inasmuch as this "natural Seventh" has no place in our harmonic system, the solution of the many problems connected with our system of harmony does not depend on the answer to this question. It is very improbable that there exists any consensus of opinion among musicians themselves as to whether this interval (4 : 7) is consonant. Those who have been accustomed to regard the chord of the Dominant Seventh as a "fundamental discord" formed by means of the "natural Seventh," would probably tell us that this interval is dissonant. Others, again, would be of opinion that in itself it is a consonance. One thing, however, is certain: Its employment in harmony and in the art of music would necessitate a change in our harmonic system.

But how then, it may be objected, explain other upper partial tones which are higher than the seventh? Take for example *d''*, which is the Ninth upper partial of *C*. Of the nature of this interval there has never been any division of opinion among musicians. It has been consistently regarded as a dissonance, and in the form of the major Ninth (4 : 9), or major Second (8 : 9), it has long been actually used in music. Is this interval derived from the harmonic series, and if so, why should it have found a place in our harmonic system while the "natural Seventh" is excluded? This question is not difficult to answer. The ear does not regard *C*, but *g*, as the fundamental sound or bass to which *d''* must be related; that is, *d''* is Fifth (Twelfth) of *g*. In acting as it does in this way, the ear allies itself in a most striking way with the operations of Nature. For as Rameau points out¹, not only *C* gives rise to a certain order of harmonic sounds; its Fifth, or Twelfth, *g*, gives rise to the same order of sounds; thus :—



¹ See following chapter.

For this reason *g* itself becomes a fundamental sound, and is the true Fundamental Bass of *d*".

Finally, there is little difficulty in disposing of the remarks of Fétis concerning his alleged discovery of the tritone in the resonance of a metal plate. Why, asks Fétis in effect, does Rameau not accept this "natural discord," and why does he not acknowledge this particular metal plate as its source? One cannot fail to admire the audacity with which Fétis advances such a criticism, nor to perceive how little he understood Rameau's theory. It is true that Rameau well nigh wrecks his theory in treating as he does of "fundamental discords" formed from added Thirds. But it is not Rameau, who throughout all his works consistently excluded the "natural Seventh" from chords, whom we have to thank for the introduction of "natural discords" into the theory of harmony, but in the main Fétis himself. It was Fétis who was one of the first to maintain that the chord of the Dominant Seventh is derived from the "natural Seventh," and that it corresponds with the proportions 4 : 5 : 6 : 7. The tritone then, according to Fétis, is determined by the proportion 7 : 10. But Rameau gave the tritone quite a different explanation; it was not a "natural discord." It is not against Rameau that Fétis should have directed his criticism, but against himself, and all other theorists who have indulged in "natural discords."

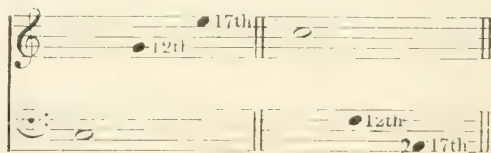
These theoretical considerations might well have induced Fétis to exchange his prerogative of "philosophic liberty" for, at least, an attitude of "philosophic doubt." They may serve to indicate that Rameau in developing his principles is on the right track, notwithstanding the contradictions and even absurdities into which he frequently falls. But even if these considerations were not present, and we were unable to evoke in ourselves Rameau's enthusiasm for and faith in his sonorous body, with its harmonic divisions, it might be wise to reserve our judgment until we meet with a metaphysical or psychological theory of harmony which does not lead us into still greater difficulties.

CHAPTER VII.

FURTHER DEVELOPMENT OF RAMEAU'S THEORIES: *GÉNÉRATION HARMONIQUE* AND *DÉMONSTRATION DU PRINCIPE DE L'HARMONIE* (continued).

DIATONIC SYSTEM (MAJOR MODE).

RAMEAU now takes as his fundamental principle of harmony the resonance of a sonorous body, which in addition to the fundamental sound causes to be heard also the sounds of the Twelfth and Seventeenth above, while at the same time it sets in co-vibration with it—according to Rameau—the sounds of the Twelfth and Seventeenth below:—



The origin of all harmony, then, is to be found in a single sound; all chords, whether consonant or dissonant, the Modes, Harmonic succession (Fundamental Bass), progressions, proportions, Cadences, Key-relationship, Temperament even—all may be traced back to this source. In the *Génération Harmonique*, therefore, we find that the first chapter—which contains the *Propositions* and *Expériences* we have already examined—is entitled: "Origin of Harmony"; Chapter 4, "Origin of fundamental and harmonic successions from which are derived geometric progressions"; Chapter 5, "Origin of Consonances and Dissonances"; Chapter 6, "Origin of the Diatonic System (*genre*), of Tetrachords, and Systems ancient and modern," and so on in the case of the majority of the other chapters. These, and especially the modifications and further development which Rameau's theoretical

principles undergo, here, as well as in his *Démonstration du principe de l'harmonie*, have now to be noticed. Let us first of all examine Rameau's explanation of the origin and nature of our Diatonic System (Major Mode).

A musical sound, begins Rameau, being not simple but harmonious in its nature, will always represent its harmony. "The grave and dominating sound, which is generally thought to be a single sound. . . . is always necessarily accompanied by two other sounds which we will call harmonic. If this fundamental sound changes its position, it is none the less accompanied by the sounds of its harmony. . . . It is necessary, therefore, always to consider the sound in its three-fold aspect.¹ "When we hear any sound, we hear also its harmony, and are preoccupied in favour of its Fifth, as its most perfect consonance: consequently, if we do not intone this Fifth after the sound first given, we intone one of the sounds of its harmony, which then represents its fundamental sound" (*"qui représentent toujours leur son fondamental"*).² Rameau means as follows:—If, for example, *c* is the sound first intoned, we accept this sound as Tonic, and naturally intone after it if not its Fifth *g*, then one of the harmonic sounds of this *g*, that is either *d*, a tone above *c*, or *b* a semitone below it. Both *d* and *b* represent the harmony of *g*, the Fifth of *c*.

Given then our single sound, how is the mode, the scale, to be developed from this sound? "In the sonorous body," proceeds Rameau, "the only sounds present are the fundamental sound, its Octave, Fifth, and major Third: these are the only sounds at our disposal, and the only liberty we have is to take these sounds successively upwards [harmonic progression], as well as downwards [arithmetical progression]. But how then ought we to regard the sound which succeeds the fundamental sound? Ought we to consider it as a new

¹ Dr. Riemann, who in his brief analysis of some points of Rameau's theory (*Geschichte der Musiktheorie*, Chap. 2, pp. 454-470) has done excellent service in drawing attention to the importance, even for present-day theory, of Rameau's researches, appears to do Rameau less than justice when he remarks:—"Helmholtz has opened up quite new perspectives by his conception of klang-representation. Theorists may have suspected it, but no one has said (!) that tones may be regarded as the representatives of klangs." (*Die Natur der Harmonik*, p. 28.)

² *Gén. Harm.*, Ch. 18, Art. 2.

fundamental, or as harmonic ? [*representing* the fundamental]. This indeed, is the great difficulty. If it is harmonic, there can be no [fundamental] succession, and we shall be dependent always on the same fundamental: then the sound which succeeds that first given must be regarded as a new fundamental. . . . This is necessary, since one cannot hear it apart from the first, except in a new sonorous body, which in its totality corresponds to it. For in passing from one sound to another, we pass from one sonorous body to another; every tone of the voice, every pipe, every string are so many different sonorous bodies, and consequently so many different fundamental sounds. . . . From this succession, which we regard as fundamental, it follows that each of the sounds carries its particular harmony; . . . consequently from such a fundamental succession there necessarily results a harmonic one. For example, when 3 [the Fifth] succeeds 1 [the Prime], the harmony of 3 succeeds that of 1, and the difference is, that if the succession of fundamental sounds is determined, that of the harmonic sounds is arbitrary; in this respect, that as each of them *represents* the fundamental sound, from which they proceed, the one can be indifferently substituted for the other. . . . Hence there follows an indispensable principle which is that we must be guided only by the fundamental succession, while on the other hand the terms of the harmonic or arithmetical proportion should be considered only as representing their fundamental sound. . . . This principle, once understood, proves that the only sounds which can succeed the sound first given are the Octave, Fifth, and major Third; whence the relationships of these intervals being known, it is quite easy to imagine, in such a case, progressions determined by each of these relationships." ¹

This not very lucid, even in some respects contradictory, statement of Rameau is important. What he means is evidently this:—A sound being given, the only sounds which we have to follow this given sound are those which compose its harmony. Thus, if *c* be the given sound, we may take after it its Octave, *c'*, Fifth *g*, or major Third *e*, but these only. But as both *c* and *g* represent the fundamental sound *c*, no progress or movement to a fresh harmony can be made so long as these sounds are regarded in their harmonic aspect

¹ *Gén. Harm.*, Ch. 4.

we obtain the sounds *c-g-c*, and *g-b-d* (*a*). These sounds being approximated in diatonic order, by means of the identity which we perceive to exist between octave sounds, we obtain the tetrachord *b-c-d-e* (*b*) consisting of the following degrees :—

<i>b-c</i> , a major (diatonic) Semitone	= 15 : 16.
<i>c-d</i> , a major Tone	= 8 : 9.
<i>d-e</i> , a minor Tone	= 9 : 10.

“ If these are the smallest degrees which can result from such a succession, where everything is derived from one and the same sonorous body, it is necessary to regard them as the only natural degrees ; we see this ; we feel it. If it be objected that the minor [chromatic] semitone does not find a place here, it has to be pointed out that this is not nearly so natural, as we shall show later.”¹ Rameau thinks that he has here re-discovered the ancient Greek tetrachord (Dorian tetrachord) which formed the foundation of Greek theory in regard to their tone-systems. “ It is from just this diatonic order (*b¹. c¹. d¹. e*) that the Greeks formed their diatonic systems, to which they gave the name of tetrachords ; its origin is to be found in the fundamental succession in Fifths. . . . It is astonishing that the Ancients have thus discovered one of the immediate consequences of this principle, without having perceived the principle itself, without even having followed it in the proportions which they assigned to the intervals of their tetrachords.”²

Notwithstanding Rameau's newly-found admiration for the Greeks, he is nevertheless disposed to censure them, in that they had discovered a diatonic system without, apparently, being aware that this system really has its origin in the Fundamental Bass. Zarlino also comes in for a share of his criticism. “ This author,” he remarks, “ starts with the harmonic proportion, and consequently derives from it the Octave, Fifth, and major Third, and indeed nearly all the consonances. He discovers even the major and minor tone. But in order to obtain the semitones he is obliged to abandon his principle, and can only derive them from the intervals which he has just obtained by his divisions. Such was the practice of the Ancients, since all say that they derived

¹ *Gén. Harm.*, Ch. 6.

² *Ibid.*, Art. 2.

the tone from the difference between the Fifth and the Fourth.”¹

But in order to complete the diatonic scale, it is necessary that a second tetrachord be added to the first. This new tetrachord is obtained by the addition of a new sound to the Fundamental Bass, which so far has consisted of the succession from Tonic to Dominant. As in this succession the fundamental bass proceeded a Fifth upwards, to the Dominant, the new fundamental sound necessary will be discovered by allowing the bass to proceed from the Tonic to the Fifth below—the Subdominant.² The ascending progression of the Fundamental Bass has already been explained: the descending progression is justified by the power possessed by the Tonic of exciting co-vibration in the sound lying a Twelfth (Fifth) below. The first is a harmonic progression; the second is an arithmetical one. Thus we obtain all the notes of the diatonic major scale, by means of a triple progression of the fundamental bass, as C—G—D

1 : 3 : 9

Major $\frac{1}{2}$ tone. Major tone. Minor $\frac{1}{2}$ tone. Major tone. Major tone. Minor $\frac{1}{2}$ tone. Major tone. Major $\frac{1}{2}$ tone.

21 : 27 : 30 : 32 : 36 : 40 : 36 : 45 : 48

9 3 9 3 1 3 1 3 9 3

(It is necessary, Rameau explains, to take here G as Tonic, otherwise confusion might result in respect of the terms of the proportion, as for example, $\left(\frac{F}{3} - \frac{C}{1} - \frac{G}{\frac{1}{3}}\right)$).

It will be observed that a break is made at the sixth degree of the scale. This is necessary owing to the succession of three whole-tones which “as one is aware, as one feels, are not natural, and they are so little natural that they can never be obtained from a fundamental succession in Fifths [1]. To obtain them it would be necessary to allow 1 to be followed by 9, in which case the third sound (*f*♯)

¹ *Gén. Harm.*, Preface.

² *Ibid.*, Ch. 6, Art. 5.

proves afresh the want of relationship between these harmonies. For if the harmony of 1 is 1 : 3 : 5, and that of 9 is 9 : 27 : 45, if we double 1 and 5, so as to approximate them to 27 (that is $1 : 27 = \frac{C - A}{16 : 27}$, and $5 : 27 = \frac{E - A}{20 : 27}$) there is found between 16 : 27 a major Sixth which is too large by a comma (80 : 81), while the inversion of this Sixth gives us a minor Third a comma too small. Also between 20 : 27 we have a Fourth a comma too large; and the inversion 27 : 40 gives us a Fifth a comma too small. Therefore, as the harmonic succession is a necessary consequence of the fundamental one, 1 and 9 cannot immediately succeed one another without making the want of relationship between their harmonies perceptible; and this is the cause of the disagreeable effect produced by the third tone." ¹

Rameau treats of this also in the *Démonst. du Principe de l'Harmonie* (p. 44), although not quite in the same way. We may represent, he remarks, the triple progression by $F - C - G$ or $C - G - D$. In the first case, C will represent $3 : 9 : 27$ or $9 : 27 : 81$. In the second case, G. The Fundamental Bass may proceed either to its Fifth above, as C-G, or to its Fifth below, as C-F. In either case, the succession is perfect: that is, the intervals thus obtained are of just proportion. But we cannot have a fundamental succession of the two Dominants $F - G$ because, as the note $\frac{D}{81}$ is a constituent of the harmony of G, by making the two sounds F and G of the Fundamental Bass succeed one another, we obtain a false minor Third $D-F$. "We cannot hear $\frac{F}{3}$ and $\frac{G}{27}$ together without $\frac{D}{81}$ being understood, since this 81 naturally sounds along with 27. But from 3 to 81 is the same as from 1 to 27, these being the first and fourth terms of the triple progression, forming between them a minor Third which is a comma too small. . . . This is evident proof of the want of relationship between 3 and 27." "It has never been known why three whole-tones in succession gave an

¹ *Gén. Harm.*, Ch. 5, Art. 5.

unpleasant effect; they can never result from a fundamental succession in Fifths, and the progression which causes them [as 1 : 9] gives us, between the harmonic sounds, intervals proscribed by Nature."¹

Nevertheless, Rameau has an uneasy feeling that all is not right. "One makes use, however, of these three tones in succession."² Besides, he has set out to prove that the diatonic Major Mode is not only derived from a natural principle, but is itself a natural product. "It is from the resonance of the sonorous body alone that arise all our impressions of harmony and of its most natural succession; for it is it alone which contains, which comprises within the limits of its two Fifths this most natural sequence of sounds known as the *Natural Mode* (*Mode Naturel*)."³ Rameau is evidently much embarrassed by his inability to make the notes of the diatonic order, starting with the Tonic and proceeding upwards by degrees to its Octave, fit his Fundamental Bass. He thinks this might be effected by considering the diatonic major scale to consist of two disjunct tetrachords. After the first tetrachord a break would occur, a point of repose, "a repose by virtue of which that which is past is forgotten."⁴ But the second tetrachord would then be in a different key from the first. "This repose marks a change of key, as soon as it occurs, since another sound is taken as the Principal." That is:—

Tetrachord. Δ Point of repose.

Tetrachord.

3 : 9 : 3 : 1 9 : 27 : 9 : 3

where in the first tetrachord $\frac{G}{3}$ is the Principal, or middle term, that is, the Tonic, but in the second tetrachord $\frac{D}{9}$. He is of opinion that we have not sufficiently profited by

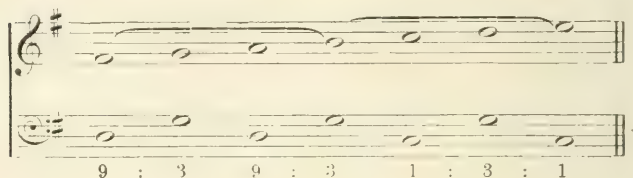
¹ *Gén. Harm.*, Ch. 6, Art. 5.

³ *Ibid.*, Ch. 6, Conclusions.

² *Ibid.*

⁴ *Ibid.*, Ch. 6, Art. 5.

the wisdom shown by the Greeks in the disposition of their tetrachords; for they made these either disjunct (as above), or conjunct, beginning with the semitone (that is $\widehat{b-c-d-e-f-g-a}$)¹: "it is only by this last means that one can continue the diatonic order, whether ascending or descending, without changing the Mode" [key]². Here, the three whole-tones in succession do not occur:—



But Rameau does not mean to give up the attempt to prove that the major mode is in reality a natural product, and that it is possible to find a Fundamental Bass for it. This he hopes to achieve by means of *Dissonance* (*double employment* of dissonance). By this means "the diatonic order can commence with the principal sound, and continue without interruption up to its octave."³

¹ Rameau here forgets that the Greeks regarded their tetrachords not as an ascending, but as a *descending* succession of tones and semitones. Thus the Dorian tetrachord of the Greeks, $\widehat{e-f-g-a}$, commenced, not with a semitone, but a tone. He also forgets that each of his tetrachords has "natural," not Pythagorean Thirds.

² *Gén. Harm.*, Ch. 6, Art. 5.

³ *Ibid.*, Chap. 11.

HARMONIC DISSONANCE: "DOUBLE EMPLOYMENT OF DISSONANCE" AND THE CHORD OF THE ADDED SIXTH.

Dissonance in music is, according to Rameau, a necessity, and the cause of this necessity he explains much in the same way as in the *Traité* and *Nouveau Système*. Owing to the uniformity of the harmony of the three sounds of the Fundamental Bass, it is impossible, Rameau considers, for the ear to decide which of the three sounds in question must be regarded as "Principal," or Tonic.

"If the first two fundamental sounds which succeed one another have nothing distinctive in their harmony, the third will always be arbitrary; and, in consequence, the principal sound, as well as the key, will never be perfectly decided."¹ In making the Dominant and Subdominant harmonies for this reason dissonant, Rameau's method of procedure is somewhat different from that which he has followed in his *Traité*, and leads to his famous device of the "double employment (*double emploi*) of dissonance" by means of the chord of the Added Sixth. The interval, begins Rameau, which ought to be added to the Dominant and Subdominant harmonies in order to render these dissonant, is the minor Third, because "as we have seen, the minor Third is the smallest harmonic interval."² Next comes the question as to where this minor Third should be placed; and here one or two considerations claim our attention. First, as no chord can exceed the extent of an Octave, this Octave "provides us with a gap (*vuide*) in which the new sound may be placed" (thus in the harmony *g-b-d'—g'*, the "gap" occurs between *d'* and *g'*). Again, the new sound should be one of the notes of the scale or key in which the original harmony occurs. "The harmonic sounds of the Mode cannot be altered or changed with altering the Mode." Further, in adding this Third, the imperfection of the Subdominant harmony, as compared with the Dominant harmony, should be kept in mind: the former arises from the arithmetical (descending) proportion, but the latter from the harmonic (ascending) proportion: "the same subordination should exist between the Subdominant as compared with the Dominant harmony, as between this and the Tonic."³ "If the Third which

¹ *Gén. Harm.*, Ch. 9.

² *Ibid.*
³ *Ibid.*

is thus to be added must be derived from the same Mode, if its diatonic movement, or direction, must conform to that which the fundamental succession has already determined for it; and if its situation as well as its species (*genre*) ought to conform to the proportion whence proceeds the fundamental sound to which it is added, then it must be *minor*, and must be added *above* the Dominant harmony and *below* that of the Subdominant; seeing that the Dominant arises from the harmonic proportion, in which the minor Third is at the top (that is $C \quad c \quad g \quad c' \quad e' \quad g'$ $\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}$ whereas the Subdominant arises from the arithmetical proportion, where the minor Third is at the bottom "1 $(F \quad A \flat \quad c \quad f \quad c' \quad c'')$ $\frac{6}{6}, \frac{5}{4}, \frac{4}{6}, \frac{3}{6}, \frac{2}{6}, \frac{1}{6}$).

The Dominant dissonance, then, will appear as

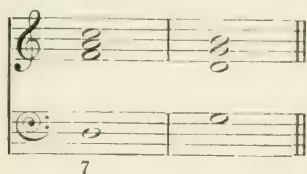
$\overbrace{g - b - d - f}^{\text{Min. 3rd}}$	$\overbrace{d - f - a - c}^{\text{Min. 3rd}}$
$36 : 45 : 54 : 64$	$27 : 32 : 40 : 48$

In the first case, the minor Third $d-f$ is added *above* the Dominant harmony; in the second case, *below* the Subdominant harmony. It will be noticed that in each discord, the added minor Third has the proportion $27 : 32$; this is not a just minor Third, being a comma too small. This however, Rameau thinks, ought to be regarded as a happy circumstance, for by this means the dissonant nature of each chord is impressed all the more strongly on the ear.¹ The new sound f , which is added above the Dominant harmony, is the *fundamental note* of the Subdominant chord; while on the other hand the new sound d , added below the Subdominant harmony, is not the fundamental but the *Fifth* of the Dominant chord. In this way, the subordinate position which distinguishes the Subdominant as compared with that of the Dominant is preserved. This union, so to speak, of the two extreme terms Dominant and Subdominant, by means of the added dissonant sound, forces each of the dissonant chords in question to return to the Tonic harmony: "it connects each with the principal sound in such a way that they cannot remove themselves from it."²

¹ "Les deux mêmes sons, *la* und *ut* (or *ré-fa*) forment de chaque côté la tierce mineure ajoutée, dont le rapport est même altéré, pour mieux y faire sentir la dissonance." (*Gén. Harm.*, Ch. 9.)

² *Ibid.*, Ch. 9.

What then must we consider to be the fundamental note of the chord $d-f-a-c'$? Is it f , or is it d ? According to Rameau, d is the fundamental note of this chord. This form of the chord is the most perfect, as it is composed of Thirds, resembling in this respect the Dominant discord.¹ It has also a similar (cadential) resolution. "The order of the harmony which is found above this new fundamental sound, being like that of the Dominant. . . . obliges us to treat this sound as a dominant, which must then descend a Fifth." That is :—



The chief difficulty, however, is not with the chord in the position $d-f-a-c'$, but in the position $f-a-c'-d'$. Already in the *Traité*, Rameau had at some length discussed this chord (chord of the Added Sixth, see pp. 112, 113). We saw how he attempted to prove that it was possible to consider the chord $f-a-c'-d'$ in two aspects: first, as an original and fundamental discord, with fundamental note f ; secondly, as the first inversion of the chord of the Seventh $d-f-a-c'$ with fundamental note d . In the *Génération Harmonique*, he makes a fresh attempt to prove that the chord $f-a-c'-d'$ is an original and fundamental, as well as a "derived" or inverted chord. "If the Subdominant," he remarks, "receives the new minor Third below it, note that in accordance with the first order of the arithmetical proportion, and its necessary subordination to the harmonic, this Third may appear as a major

Sixth, *above* the same Subdominant; since in

	Maj. 6th 5th		
	5	3	1
	f	d	a

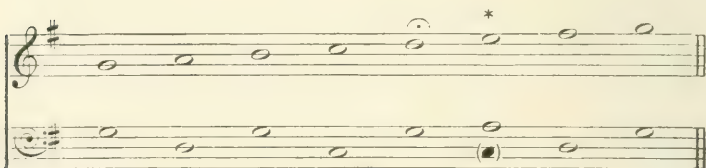
in which the lowest sound must be regarded as fundamental, the major Sixth is direct."² Such is Rameau's new and

¹ *Gén. Harm.*, Ch. 9.

² *Ibid.*

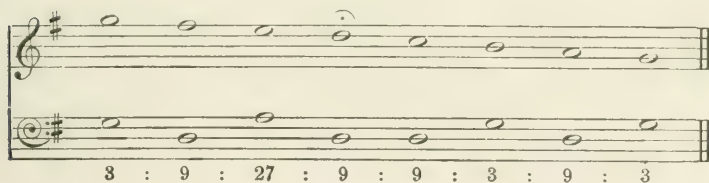
extraordinary explanation of the origin of the chord of the Added Sixth. Here d , the added and dissonant note of the chord $f-a-c'-d'$ is found to be a constituent of the proportion $5:3:1$, while c' , the consonant Fifth of the chord, finds and indeed can find no place.

Rameau's long, confused, and contradictory explanations of the nature of this chord are all directed towards one object : he wishes the chord $f-a-c'-d'$ to be considered in a two-fold aspect—as an original chord, with fundamental note f ; and secondly, as the first inversion of the chord $d-f-a-c'$, with fundamental note d . Not only so, he wishes to consider the chord $f-a-c'-d'$ as an original *and* a derived chord, at one and the same time. This is the “*double emploi*,” which Rameau regards as “one of the most happy discoveries.” “It is just this chord,” he proceeds, “that we stand in need of in order to carry the diatonic succession up to the Octave.” The manner in which he accomplishes this is as follows :—



Here, in order to avoid the Subdominant-Dominant succession, Rameau considers the note c^* to form part of the chord of the Added Sixth $c-c-g-a$, of which c is the reputed fundamental note : he then regards this chord as changing its aspect ; it is now to be considered as the first inversion of the chord of the Seventh $a-c-e-g$, of which a is the fundamental note. This chord then finds its natural resolution on the Dominant chord $d-f\sharp-a-c$, and thus by means of this “double employment of dissonance” the complete diatonic scale is made to fit the Fundamental Bass ; or more accurately, the Fundamental Bass is made to fit the scale. But the Tritone and the “altered consonances” are still there ! Rameau, as was to be expected, finds himself totally unable to banish dissonant intervals from the scale. He makes repeated

attempts, but neither by any system of conjunct or disjunct tetrachords, nor by any device such as "double employment," can he prevent the intrusion of "altered consonances"—in reality dissonances—into what he rightly or wrongly considers to be the *natural* Major Mode. The above scale he considers to consist of two disjunct tetrachords, *g-a-b-c* and *d-e-f#-g*, but somewhat inconsistently, he wishes the break or point of disjunction to occur, not after the note *c*, the fourth degree, but after *d*, the fifth degree of the scale: after such a break, he remarks, the progression of the fundamental may be expected to be somewhat arbitrary in character! Rameau makes an attempt to justify his procedure in this respect by a reference to the practice of composers, who in harmonizing the descending major scale "change the key, that is, the principal sound, giving this to the Dominant 9, and assigning to this sound a point of repose"¹:—



Here the sounds of the Fundamental Bass are all comprised in the three terms 3 : 9 : 27, of which the central term 9 must, according to Rameau, be regarded as Tonic. The term 1, which represents the Subdominant of key G, does not appear at all! The complete scale, therefore, would appear to be in the key of the Dominant, D major. Notwithstanding this apparent defect, which Rameau does not appear to have noticed, it must be admitted that this harmonization of the scale is a vast improvement, from a musical point of view, on his version of the ascending scale.

In the *Démonst. du Principe de l'Harmonie*, Rameau makes a still further attempt to adapt his Fundamental Bass

³ *Gén. Harm.*, Ch. 11.

to the ascending major scale. He now considers it necessary to make a modulation to the Dominant key :—



Here, at the point of repose, G*, Rameau changes the Fundamental Bass: for the terms $\text{F} - \text{C} - \text{G}$ he substitutes $\text{C} - \text{G} - \text{D}$. This G, formerly Dominant, now becomes Tonic, and the second tetrachord appears in the key of G major. "At *sol*," observes Rameau, "there begins a new tetrachord, similar in its proportions to the first, in which the two tones it contains are taken with the same facility as in that which immediately precedes it: this becomes for the ear a new harmonic phrase, whose connection with what precedes it no longer claims our attention: in fact in this new phrase the key changes, and this is evident from the necessity to make 81 succeed 27." As for the "altered consonances," matters are worse than before. For now besides the false minor Third *d-f*, we find an altered major Third *f-a* (64:81) a comma too large, and an altered minor Third *a-c* (27:32) a comma too small. It is noteworthy that in the *Démonstration* Rameau makes no use of "double employment." He indeed refers to the subject, but dismisses it in a word. Speaking of the two-fold aspect which the sixth degree of the scale may assume, namely in the C major scale as Third of *f*, or Fifth of *d*, he remarks: "One should observe in this connection how the question of "double employment" arises, since it matters little to the ear as to whether *la* should be related to *fa* 3 as Third, or to *ré* 81 as Fifth, seeing that it forms with its Fundamental Bass in each case a consonance of just proportion."

In all this the change of key which arises in harmonizing

the scale by means of the Fundamental Bass, the impossibility of making the extreme terms of the triple progression succeed one another, the "altered consonances" which arise between the sounds of the scale—Rameau sees, however, only the necessity for *Temperament*; even more, its origin. He remarks:—"The mode, in its origin, prescribes temperament as a necessity, since the diatonic succession cannot reach its full extent, that is, cannot be extended from a note to its Octave, without an essential fault, whether as regards the three tones in succession, the necessity to abandon the fundamental succession in Fifths, in order to substitute for it one, as that between 1 and 9, which produces false consonances between its harmonic sounds; or finally the necessity to make use of a new fundamental sound at the Fifth of one of the two extremes in order to extend the diatonic succession up to the Octave."¹

Such is the extremely important development which Rameau's theory of the fundamental bass undergoes in the *Génération Harmonique*, and which, before we touch on the question of *Temperament*, we must examine more closely.

EXAMINATION OF RAMEAU'S VIEWS CONCERNING THE ORIGIN AND NATURE OF THE KEY-SYSTEM; DIFFICULTIES IN CONNECTION WITH THE SUBDOMINANT; HELMHOLTZ'S THEORY OF THE ORIGIN OF SCALES; DIFFICULTIES CONNECTED WITH THE TRITONE, "DOUBLE EMPLOYMENT," "FALSE INTERVALS" OF THE SCALE.

These investigations of Rameau into the nature of the Diatonic System, of Dissonance, "double employment," etc., are of the utmost importance, containing as they do the very essence of his fully developed and matured theory of harmony. Here once again we discover not only Rameau the musician, with a fineness of ear, with an intuitive perception of tonal relations, as these find expression in our modern

¹ *Gén. Harm.*, Ch. 7.

harmonic system, amounting to positive genius, but also Rameau the by no means clear-headed theorist, who has no sooner taken up a definite position than he straightway proceeds to demolish it by a statement of the most flagrantly contradictory character. Rameau, however, is apparently less intent on system-building than on the discovery of truth : and in this he claims our respect, as one of the most honest of theorists.

Rameau makes the notable pronouncement that the sounds of the scale, whether of the Major or Minor Mode, have their origin in a series of harmonic successions determined by a Fundamental Bass in Fifths, in which a central sound is taken as Tonic, and a harmonic progression is made to the Fifth above (the Dominant) and to the Fifth below (the Subdominant). In this sense, our diatonic system is a *Fifth-system*, and arises solely out of the chief harmonies of the key, those namely of the Tonic, Dominant, and Subdominant. The influence of this Fundamental Bass of Rameau was widespread and powerful ; even if it was not fully understood, and its theoretical significance not adequately realised, it nevertheless came to be regarded as the central point of his theory, and was held as an article of faith by many musicians and theorists up to the end of the eighteenth century. By the beginning of the nineteenth century, however, it began to be considered as no longer adequate for the growing needs of composers, or for the explanation of the many new harmonic combinations and successions which had, since Rameau's time, been evolved by composers themselves. Mozart and Beethoven had, it was thought, given the *coup-de-grâce* to the system of the Fundamental Bass. It soon became almost forgotten, and ever greater importance began to be attached to that other—unfortunate—aspect of Rameau's theory, namely, the generation of chords by means of Added Thirds. In our own day, however, there has been witnessed the *renaissance* of the fundamental bass : its real significance for the theory of harmony is being more adequately realized (Helmholtz, Riemann, etc.), while, on the other hand, the generation of chords by means of added Thirds is falling more and more into discredit.

The inquiry with which Rameau begins is a pertinent one. Given the first sound, for example *c*, what sound is to follow it ?

And how is this sound to be determined? ¹ In the diatonic succession of sounds there must clearly be some underlying principle determining such a succession, and this principle must be a harmonic one. If not, what other principle is there? There is none. It is harmony then which impels us, after the first sound *c*, to intone that sound which after the Octave is most perfectly consonant with it, namely, *g*, its Fifth (or at least one of the harmonic sounds of this Fifth, that is, *d* or *b*) or *e*, its major Third. Of these two sounds *g* and *e*, *g* is first in the order of generation of the harmonic sounds. Both are harmonic constituents of the fundamental sound *c*, and represent this sound. The succession of sounds *c-e-g* may then in a sense be described as a melodic succession. But each of the sounds *e* and *g* may be regarded in another aspect, namely, as itself a fundamental sound, bearing its own harmony. In proceeding, then, from one to another of the sounds *c* and *g* there arises a Fundamental Bass in Fifths, and from this fundamental succession *c-e-g-g-b-d* we obtain a tetrachord of the form $\widehat{b-c-d-e}$. In a similar way, by means of a fundamental succession between the principal sound and that lying a Fifth below (Subdominant) we obtain the tetrachord $\widehat{c-f-g-a}$. These two tetrachords when joined together furnish us, in correct proportions, with all the sounds of the Diatonic Major Scale.

¹ The following passage from the *Démonst. du Principe de l'Harmonie* (p. 8. *et seq.*) shows how strongly Rameau was influenced in his scientific researches by the philosophic "*Méthode*" of Descartes. Here Rameau describes how, in order to discover what sound is most naturally intoned after a given sound, he endeavoured to place himself in the position of a man totally unacquainted with music! "I found, in truth," he remarks, "that there were certain sounds for which my voice and ear appeared to have a predilection [namely, the Fifth and Fourth] . . . but this predilection appeared to me to be purely a matter of custom. . . . I therefore placed myself, as far as I possibly could, in the position of a man who had never tried to sing, nor had even heard music. . . . That done, I searched around me, and in Nature, for what I could not find in myself. . . . My search was not a long one. The first sound which fell on my ear was for me as a ray of light; I perceived at once that it was not a single but a composite sound; there, said I, is the difference between noise and [musical] sound I named the first sound or generator '*fundamental sound*'; its concomitants 'harmonic sounds'; and there I had three things quite distinct, and of natural origin—noise, *fundamental* sounds, and *harmonic* sounds."

Rameau now presents us with what appears to be a regular, logical, and symmetrical Key-System, arising out of the three

chief harmonies of the key or Mode : $\overbrace{c - e - g}^{c - e - g}$
 $\underbrace{f - a - c}_{f - a - c} \quad \underbrace{g - b - d}_{g - b - d}$

the Tonic harmony occupying the central position, while the Dominant harmony is represented as that of the upper Fifth, and the Subdominant harmony that of the lower Fifth. That is, our diatonic system is a Fifth system. "It is in the Fifth alone," Rameau tells us, "that the Diatonic System has its origin."¹ (Rameau, of course, refers here to the fundamental succession of the bass, above each term of which the complete harmony, Third as well as Fifth, is understood.) In Chapter 4. (*Gén. Harm.*), also, he gives the following table :—

sol - *ré* - *la* - *mi* - *si* - *fa* - *Ut* - *sol* - *ré* - *la* - *mi* - *si* - *fa* \sharp
 729 243 81 27 9 3 \uparrow $\frac{1}{3}$ $\frac{1}{9}$ $\frac{2}{27}$ $\frac{1}{81}$ $\frac{2}{243}$ $\frac{1}{729}$

where we find the key-system extending upwards (harmonic progression) and downwards (arithmetical progression) from the central sound *Ut*; but in which any three terms, of which the central term is taken as Tonic, will represent the fundamental harmonies of the diatonic key system. By means of the progression of these three fundamental sounds, the key admits of the clearest possible definition :—



(at least, Rameau might quite well have maintained this; we have seen, however, that he considers *dissonance* to be necessary for the proper definition of the key).

² *Gén. Harm.*, Ch. 6.

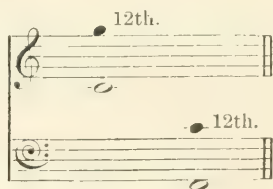
From such a Fundamental Bass there follows a whole train of consequences of the utmost importance for the science of harmony; as connection and succession of chords, resolution of dissonance, modulation, cadences, etc. In the case of the last, for example, Rameau points out how completely the different effects produced by the various cadences correspond with his explanation of their origin. We also find, in a striking manner, the Tonic determined as the centre of the whole key-system, the note to which the other notes of the scale not only are related, but from which they arise. The Tonic harmony also appears as the central harmony, towards which all other chords or discords tend to gravitate.

So clear an exposition does Rameau's theory of the three chief harmonies of the key, Tonic, Dominant and Subdominant, their tonal functions, determination of Cadence, etc., appear to furnish of the nature of our diatonic and harmonic systems, that one feels disposed to accept it without further examination. But whether or not it be regarded as necessary for a correct understanding of much in our harmonic system, it must nevertheless be pointed out that it has never yet been conclusively established. Rameau does not succeed in finding for the Fundamental Bass a scientific or a rational basis. Nor have his successors. This is not surprising, for the difficulties in the way are by no means light. One or two considerations have to be noticed.

(1) In the three terms which Rameau considers to form the basis of the diatonic system, for example $F-C-G$, the relationship of both Dominants F and G towards the Tonic C is, Rameau informs us, that of the Fifth : that is, G is the Fifth (Twelfth) above C , while F is the Fifth below. But while G has its origin in the compound tone of C , F has not. F is a new sound which cannot possibly be discovered among the upper partial sounds of which C is the prime, or fundamental note. In order to discover it, Rameau is obliged to have recourse to a new acoustical phenomenon, namely, co-vibration. While then G , the Twelfth above C , is a constituent of the compound tone of C , and sounds along with it, F , the Twelfth below, co-vibrates with it. The sonorous body corresponding to this Twelfth below vibrates, Rameau assures us, throughout its whole length, while at the same time it divides itself

into three equal parts or segments, with two nodes.¹ But here Rameau makes a serious error: for this Twelfth does not vibrate throughout its whole length. It vibrates only in segments, which produce a sound corresponding not to F, the Twelfth below C, but to C itself, that is the Unison. Therefore the exciting sound C does not produce co-vibration in F, its Twelfth below. Rameau's explanation of the origin of the Subdominant is based on a faulty observation of an acoustical phenomenon. But even if he had succeeded in proving that this Subdominant does really co-vibrate with the principal sound, such an explanation would be by no means free from serious objection. Rameau's fundamental principle is that of harmonic resonance; from this everything proceeds. But while the upper Dominant arises from this principle, the lower Dominant has to be explained by means of what Rameau considers to be a quite different, a new and remarkable acoustical phenomenon, apparently unrelated to the principle of harmonic resonance.

But in fact the relationship which Rameau perceived to exist between these two sounds, the Principal and its lower Dominant, has been almost completely misunderstood, both by Rameau, and by not a few of his successors. If we take a principal sound c' , its Twelfth (third partial tone) above is g'' . In exactly the same way, we find that the Twelfth above F is c' :—



¹ "Prenez une viole, ou un violoncello, dont vous accorderez deux cordes à la douzième l'une de l'autre: raclez la grave, vous verrez frémir l'aiguë: vous l'entendrez peut-être même résonner. . . raclez ensuite l'aiguë, vous verrez non-seulement la grave frémir *dans sa totalité*, vous la verrez encore se diviser en trois parties égales, formant trois ventres de vibrations entre deux noeuds, ou points fixes. *Pour s'assurer que la corde frémit dans sa totalité*, pendant qu'elle se divise en trois, lorsque l'aiguë est raclée, il faut y effleurer les points fixes avec l'ongle, et on la sentira frémir en ces endroits." (*Gén. Harm.*, Ch. I.)

The relationship which g'' bears to its fundamental c' , is the same in every respect as that which c' bears to its fundamental F. But the central sound c' may be considered as Tonic, while g'' is its upper, and F its lower Dominant. Then the relationship between Dominant and Tonic is exactly the same as that between Tonic and Subdominant. It is merely the same process repeated a Fifth or Twelfth lower. It is, therefore, obviously as incorrect to describe F as Fifth of c' , that is, considered in a downward direction, as it would be to describe c' as Fifth of g'' . On the contrary c' is Fifth of F, just as g'' is Fifth of c' . We therefore discover the true and simple explanation of what Rameau and his followers have regarded as a strange and remarkable acoustical phenomenon. When the principal sound c' is set in vibration it causes to co-vibrate with it, not F its Twelfth below, but that portion of the string which corresponds to its third upper partial tone, this partial tone being at the Unison of the principal and exciting sound. This is easily proved, for not only may this partial tone, contrary to Rameau's belief, be heard actually to sound, but the string corresponding to the fundamental sound of which it is a partial may be observed, as Rameau had remarked, to divide itself into three segments, each of which corresponds to the sound c' . No doubt Rameau would have been agreeably surprised, at least at first, had he discovered that the relationship between Tonic and Subdominant was determined, not by a new and unrelated acoustical phenomenon, but, exactly like the relationship between Dominant and Tonic, by his first and fundamental principle of harmonic resonance.

But the elucidation of this fact only serves to introduce fresh problems: and here we light on the difficulties which have dogged the steps of every theorist who since Rameau's time has made use of the arithmetical progression. Rameau considers F to be the fundamental sound of the Subdominant harmony F-*a-c*. But he does not observe all that this implies. If the fundamental sound F is to bear a harmony like that of C and G, then in the harmony F-*a-c*, *c* must appear as Fifth of F. That is, the Tonic C appears no longer as the central and determining note, but is itself a determined note. It is absolutely necessary for Rameau's explanation of the diatonic and harmonic system that F should be a determined note, as Fifth of C. How then is it possible to maintain the exact opposite and to consider C as Fifth of F? The Fifth must

necessarily appear as a determined sound, and the sound of which it is Fifth must appear as the sound which determines it, that is, it is its fundamental. If the relationship of a fundamental sound to its Fifth may be indicated as $I = \text{Fundamental}$, $II = \text{Fifth}$, then the relationship of the two terms of the fundamental bass $\overset{F-C}{I : 3}$ must be, if C is to be regarded, as Rameau requires, as the determining sound, as $\overset{II : I}{F-C}$; but the harmony $F-a-c$ appears in the position $\overset{F-A-C}{I : II'}$ and must necessarily do so. With the Dominant harmony, the position is quite different. In the harmony $G-b-d$, the Tonic C does not appear as Fifth: it does not appear at all. If we compare the harmonies $\overset{C-e-g-b-d}{I \quad II}$ we find g, with its harmony, quite clearly represented as Fifth of C. If we compare the harmonies $\overset{F-a-c-e-g}{I \quad II}$ we find c, with its harmony, appearing as Fifth of F.

Further, from the fundamental succession of the harmonies of G and C, Rameau has generated the tetrachord $\widehat{b-c-d-e}$. Proceeding in exactly the same way, he has afterwards generated the tetrachord $\widehat{c-f-g-a}$ from the fundamental succession of the two harmonies of C and F. Both tetrachords, Rameau himself inform us, are generated in exactly the same way. In each case, then, the fundamental succession is as Dominant-Tonic, while the Subdominant finds no place. Thus Rameau is forced to make the key-system appear as $\widehat{f-a-c-e-g-b-d}$ in which 3 must be regarded as Fifth of 1, and 9 as Fifth of 3, while f the Subdominant appears as the determining sound, the foundation of the whole key-system. But if we concede to Rameau the right to regard C as determining a harmony in both an ascending and descending direction, then C appears as the generator of the two harmonies $f-a\flat-C$ and $C-c-g$. But the harmony $f-a\flat-C$ is not a major but a minor harmony. This minor harmony however, as Rameau well knows, is not the harmony of the Subdominant of the Major Mode. While

then it is impossible to deny the great importance and theoretical significance of Rameau's conception of a fundamental bass founded on the three chief harmonies of the key-system, we must nevertheless observe that Rameau does not succeed in finding for it a logical, still less a scientific basis. And what is true of Rameau is true also of his successors.

Not less important are Rameau's researches in connection with the origin of the Diatonic Scale. Here we find ourselves in the very heart of the mysteries of harmonic science, and confronted by what must still be regarded as unsolved problems. Rameau is of opinion that the Diatonic Scale owes its origin to his Fundamental Bass of three terms. In proceeding from one to another of these sounds, C and G, there arises a Fundamental Bass in Fifths, and from this fundamental succession we obtain a tetrachord of the form $\widehat{b-c-d-e}$. In a similar way, by means of a fundamental succession between the principal sound and that lying a Fifth below—the Subdominant—we obtain a quite analogous tetrachord $\widehat{e-f-g-a}$. These two tetrachords, when joined together, furnish us with all the sounds of the diatonic major scale. Rameau then compares his tetrachord with the diatonic tetrachord of the ancient Greeks. He is convinced that he has discovered the origin not only of the ancient Greek tetrachord, but also of their system of conjunct tetrachords, and he cannot avoid dwelling for an instant on the marvellous intuition of the Greeks, who, without any actual knowledge of the Fundamental Bass, but nevertheless unconsciously guided by it, were able to discover such a tetrachord. But of all comparisons this, one would think, is the very one which Rameau might have been expected to avoid most carefully; for does not the very fact of the existence of such a tetrachord and such a diatonic system among the Greeks tend to demolish his theory of the origin of the scale?

Such, at least, is the view taken by Helmholtz, who remarks:—"Theorists of our own day who have been born and bred in the system of harmonic music have supposed that they could explain the origin of scales by the assumption that all melodies arise from thinking of a harmony to them. . . . But scales existed long before there was any knowledge or experience of harmony at all. . . . The same remark applies to Rameau's assumption of an 'understood' fundamental bass in the construction of melodies or scales for a single voice. A

modern composer would certainly imagine to himself at once the fundamental bass to the melody he invents. But how could that be the case with musicians who had never heard any harmonic music, and had no idea how to compose any? Granted that an artist's genius often unconsciously 'feels out' many relations, we should be imputing too much to it if we asserted that the artist could observe relations of tones which he had never or very rarely heard, and which were destined not to be discovered and employed till many centuries after his time."¹ Helmholtz refers here to the Thirds and Sixths, which were dissonant for the Greeks and other nations of antiquity. What then is Helmholtz's explanation as to how scales first arose? He explains as follows. A note being assumed as Tonic, the other notes necessary in order to form a scale are selected from those sounds which are more or less closely related to this Tonic. "We find," he remarks, "the following series of notes related to the Tonic in the first degree, lying above the fundamental note *c*, and related to it in the first degree:—

<i>c</i>	<i>c'</i>	<i>g</i>	<i>f</i>	<i>a</i>	<i>e</i>	<i>e♭</i>
1 : 1	1 : 2	2 : 3	3 : 4	3 : 5	4 : 5	5 : 6

and the following series in the octave below:—

<i>c</i>	<i>C</i>	<i>F</i>	<i>G</i>	<i>E♭</i>	<i>A♭</i>	<i>A "</i>
1 : 1	2 : 1	3 : 2	4 : 3	5 : 3	5 : 4	6 : 5

As to the intervals which ought to be selected from the above series in order to form the scale, this is "a question which different nations have answered differently according to the different direction of their taste, and perhaps also according to the different delicacy of their ear."² Helmholtz then proceeds to show how various scales were formed according to the principle he has just enunciated. Thus the pentatonic scale *c-d-e-g-a-c'* is one of the "more irregular forms of the scale of five tones, in which the major Third *e* [4 : 5] replaces the fourth *f*, which is more nearly related to the tonic *c*." Again, one of the most ancient forms of the Greek tetrachord is explained thus:—"If we assume *c*—the last tone in the tetrachord *b-c*—as a Tonic, its next related tone within the compass of that tetrachord is *c*, the major Third below *e*.

¹ *Sensations of Tone*, Pt. III., Ch. 14.

² *Ibid.*

This gives us the ancient enharmonic tetrachord of Olympus

$b \cup c - e$ "1
 $\frac{3}{4} \quad \frac{4}{5} \quad 1$ In this, in many respects the most important section of his work, the intervals which according to Helmholtz were selected in order to form these early scales included not only the major and minor Thirds, but also the major and minor Sixths, intervals which were dissonant, as already remarked, for all antiquity. Nevertheless it is Helmholtz who inquires how scales could be formed from relations of tones which had either never been heard, or which, when heard, were rejected! If it is absurd to suppose that the diatonic scale owed its origin to Rameau's Fundamental Bass, it is no less absurd to imagine that scales first arose according to the principle enunciated by Helmholtz. The whole question is of the utmost importance for the theory of harmony. In the meantime, it may be pointed out that Helmholtz is in substantial agreement with Rameau's theory of an "understood" Fundamental Bass as applied to our modern scales. Thus the melodic succession, $c-d-e$, in which we find the first three degrees of the major scale, is determined by means of the linking sound G: thus: $\frac{c-d}{G} \quad \frac{d-e}{G}$

It is evidently for Rameau a remarkable circumstance that the progression from the central term to either of the extreme terms of his Fundamental Bass furnishes him with a series of degrees and of intervals of correct proportions. Thus in the tetrachord $b-c-d-e$ we find not only the major and minor tone ($c-d=8:9$, $d-e=9:10$, $b-c=15:16$), but also the major Third $c-e$ ($4:5$) the minor Third ($5:6$) and the perfect Fourth ($3:4$). It is indeed a noteworthy fact that these determinations of the various intervals, corresponding to the necessities of just intonation, were fixed by different theorists long before Rameau formulated his system of the Fundamental Bass. Thus in the sixteenth century Zarlino, Salinas, and others, recognize the following determinations of the intervals:—

Octave 1 : 2	
Fifth 2 : 3	Fourth 3 : 4
Major third 4 : 5	Minor third 5 : 6
Major tone 8 : 9	Minor tone 9 : 10
Diatonic semitone 15 : 16 Chromatic semitone 24 : 25.	

¹ *Sensations of Tone*, Pt. III., Ch. 14.

But indeed we already meet in Ludovico Fogliano (*Musica theorica*, 1529) with the same determinations :—

$\frac{8}{9}$	$\frac{9}{10}$	$\frac{15}{16}$	$\frac{8}{9}$	$\frac{9}{10}$	$\frac{8}{9}$	$\frac{15}{16}$	
c	d	e	f	g	a	b	c'
24	27	30	32	36	40	45	48

But Rameau's pardonable self-congratulation over this fact disappears before the difficulties with which he soon finds himself confronted. These arise, not in connection with the individual tetrachords, but with his attempt to unite them so as to form a complete scale. For, although each of his tetra-

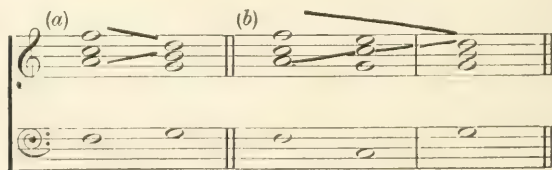
chords, $\widehat{b-c-d-e}$ and $\widehat{e-f-g-a}$, furnishes him with intervals of just proportions, no sooner has he joined both tetrachords together than there arise "altered" consonances, that is, intervals which are not consonances at all. This scale

$\widehat{b-c-d-e-f-g-a}$ however is not complete, nor does it correspond

to any of our modern scales. Rameau now re-constitutes his

tetrachords, and gives them the form $\widehat{c-d-e-f} \mid \widehat{g-a-b-c'}$. From

these disjunct tetrachords he obtains all the sounds necessary for the complete scale of c major, beginning with the Tonic c , and proceeding upwards in diatonic succession to the Octave. Here also false intervals are present. These are intervals "proscribed by nature," and their presence in the "natural" Major Mode is evidently for Rameau the occasion of considerable perplexity. Still, they are of little account so long as they are not perceived by the ear; and indeed they can never occur in a fundamental succession of the bass, which is always perfect. Thus at (a) the false intervals $d-f$ (27 : 32)



and *a-d* (20 : 27) arise in the immediate succession of the upper parts ; they are found again at (*b*), but not in immediate succession.¹ There is, therefore, this great difference between the two cases, that whereas at (*a*) the false intervals are perceived, at (*b*) they are not perceived by the ear. This argument is further developed by Rameau in his remarks on temperament.

But while Rameau has little difficulty with the first form of the scale, he is totally unable to find a Fundamental Bass for the second. Here difficulties crowd thick upon him. There is the tritone, this "essential fault" of the *natural* major mode. This can only arise from an immediate succession of the extreme terms, 1 and 9, of the Fundamental Bass. Such a succession however is impossible, and the attempt to bring it about only results in evident proofs of the want of relationship between these extreme terms : there is not only the tritone, but the false intervals which arise in immediate succession. These three whole-tones, as "one feels, are not natural," and in short they "can never result from a fundamental succession in Fifths." Here then, one would think, the whole matter comes to an end. Rameau has set out to show us that our major scale has been evolved from his fundamental bass of three terms. He now tells us plainly that the major scale can never be discovered from such a bass. It is evident that it is not the presence in the scale of "altered consonances," or of the tritone, which is the real cause of Rameau's embarrassment. Instead of exhibiting such unnecessary sensitiveness with regard to the "intrusion" of these intervals, Rameau might have deduced from them important results concerning the origin of harmonic dissonance. The tritone is less an "essential fault" than an essential part of our scale, and Rameau knows well that in harmonic music the extreme terms 1 and 9 may succeed each other quite freely. His real difficulty is, of course, to account for such an immediate succession of the two Dominants. He fails in the *Génération Harmonique*, and in the *Démonstration* he confesses his failure. On the other hand, Rameau deserves credit in that he perceives, unlike most other theorists, that some explanation is necessary.

¹ See, however the remarks on this subject in Ch. 8 (Temperament)

It is unnecessary to dwell on the contradictions and even absurdities in which he becomes involved in treating of Dissonance and the "Double employment of Dissonance." In generating the Dominant and Subdominant discords, the added interval should, he thinks, be a minor Third, because this is the smallest interval used in harmony. He also thinks that it is quite clear where this added Third should be placed, for we find a "gap" between the fundamental sound and its Octave. Thus in the chord $g-b-d-g'$, the gap occurs between the sounds $d-g'$; in this gap therefore the added third should be placed. As for the Subdominant chord, Rameau evidently assumes that the gap, in this case, occurs between $c-f$ in the $\frac{4}{4}$ position of the chord, thus: $c-f-a-c'$. In adding this dissonant sound *below* the Subdominant chord, Rameau is evidently quite satisfied that he has proved this chord to arise from the arithmetical proportion, and that it is only necessary to extend this proportion further downwards, as he extends the harmonic proportion upwards in the case of the dominant harmony. But the Third added to both harmonies (27 : 32) is not a minor Third. Rameau, however, regards this as a merit; it intensifies, he tells us, the dissonant effect of both discords. So then, as d'Alembert remarked, it is proportion which enables Rameau to form the discord; while it is the lack of proportion which renders the dissonance perceptible. Rameau does not stay to consider whether the addition of a true minor Third might not still further increase the dissonant effect. It is also to be noticed that one of the great advantages, from Rameau's point of view, in adding the dissonance below the Subdominant harmony is that the resulting dissonant chord is now similar in form to that of the Dominant, that is, it is composed of a series of Thirds!

In the Dominant discord, the added dissonant sound is the Subdominant itself; in the Subdominant discord, it is the Fifth of the Dominant. In each case the effect of the added dissonance, says Rameau, is to compel each discord to proceed to the Tonic harmony. Whether or not this be true of the Dominant discord, it is not true of the Subdominant discord. For if there is a tendency on the part of the Subdominant harmony $f-a-c$ to proceed to that of the Tonic, the tendency of the dissonant chord $d-f-a-c$ is rather to resolve on the Dominant harmony $g-b-d$. Rameau himself recognizes this, for he gives, in one and the same chapter, two absolutely contradictory

explanations of the natural tendency of this dissonant chord. First, by the union of both Dominants in this chord, it is "compelled to return to the principal sound." Secondly, "the order of the harmony above this new fundamental sound, being like that of the Dominant [Dominant Seventh] . . . obliges us to regard this new fundamental sound as a Dominant, for which reason it must descend a Fifth" (that is, resolve on the Dominant harmony). Rameau's methods reach a climax when he makes the dissonance note *d*, which is added below the Subdominant harmony *f-a-c*, the *fundamental note* of the chord *d-f-a-c*. That is, the *added* and *dissonant* note is the fundamental note of the chord! It is clear that Rameau has no foundation for his theory of "double employment of dissonance," in which it is necessary that the discord *f-a-c-d* should be regarded now as an original chord, with fundamental note *f*, and now as the first inversion of the chord of the Seventh *d-f-a-c*, according to circumstances. But there is another reason why *d* cannot be the fundamental note of the chord of the Seventh *d-f-a-c*, namely, because the intervals *d-f* and *d-a* are not harmonic intervals. Rameau does not perceive this in the *Génération Harmonique*. In the *Démonstration*, however, he sees quite clearly that if *a* is Third of *f* it cannot at the same time be Fifth of *d*. In order that *a* should appear as Fifth of *d*, it is necessary that a modulation should take place to the Dominant key. The sound *d* can then be regarded as a real fundamental sound: not as Supertonic of key C, but as Dominant of key G. It is therefore all the more remarkable that already in the *Traité*¹ Rameau should insist that the chord *f-a-c/d* must be regarded as an "original" discord, in which a dissonant note is added to the Subdominant harmony. There is, in short, no other way in which this chord can be explained, and Rameau's penetration is nowhere more manifest than in his treatment of it as a *Subdominant discord*. Unfortunately he is not consistent, and he certainly comes to grief when he tries to explain it as the first inversion of the chord of the Seventh *d-f-a-c*. He is impelled towards this by two very good reasons: first, he had laid down the principle that the Seventh is "the origin of all the dissonances," and secondly, he had to discover or invent some means whereby the extreme terms

¹ See p. 121.

of his Fundamental Bass could be brought into immediate juxtaposition.

The chord of the Added Sixth, according to Fétis, is the rock on which all theories of harmony have split; it has certainly proved one of the greatest stumbling-blocks in the way of a rational theory of harmony. It is a noteworthy fact that Fétis and Dr. Day, whose systems are almost diametrically opposed to one another, nevertheless agree in regarding this chord not as a Subdominant but as a *Dominant* discord, of which the Dominant is the "root," or fundamental note. Others find no difficulty in explaining the chord as the first inversion of the chord of the Seventh on the second degree of the scale, assigning to this second degree the position of fundamental note. All, however, agree that not *d* but *c* is the dissonant note of the chord *f-a-c-d*. The only explanation of this chord which does not appear to have been popularized in text-books of harmony is that given by Rameau, who explains it as arising from the Subdominant harmony, to which a dissonant note is added. Theorists, however, have revolted against such an explanation, owing largely to their engrained habit of regarding every "original" chord as composed of a series of added Thirds. Hence their inability to consider the chord *f-a-c/d* in any other aspect than as the first inversion of the "original" chord of the Seventh *d-f-a-c*. It is a remarkable fact that at the present day, almost two centuries after the publication of Rameau's *Traité de l'Harmonie*, theorists are reverting to the French master's explanation of this chord.

But whether or not we accept Rameau's explanation of the chord of the Added Sixth, we must at any rate reject his views as to the dual aspect which he supposes it may assume in connection with the "double employment of dissonance." Whether, as in the *Génération Harmonique*, he makes use of this "double employment" in order to find a bass for the three whole-tones in succession, or, as in the *Démonstration*, he abandons it in favour of a quite open and definite modulation to the Dominant key, Rameau is obliged to add a fourth term (27) to the three terms (1 : 3 : 9) from which, he has told us, the whole key system is evolved. That is, the Fundamental Bass has four, not three terms, the diatonic system is not in one, but in two keys, and it has its origin in two generators. Such is the by no means satisfactory result of Rameau's

strenuous endeavours to demonstrate that the key-system has been evolved from a single generator.

Finally, it has to be pointed out that while Rameau, by his Fundamental Bass of three terms, puts us in possession of the three chief harmonies of the major key-system, namely, the major harmonies on the first, fourth and fifth degrees of the scale, *he is quite unable to inform us whence we obtain the minor harmonies on the third and sixth degrees.*¹ This, however, is one of the principal difficulties in the way of the theory of the Fundamental Bass and of harmony: the explanation of these minor harmonies is an absolute necessity. As for the diminished triad on the seventh degree, Rameau is disposed to consider this as derived from the chord of the Dominant Seventh.

In treating of this part of his subject, and especially of "double employment," Rameau is convinced that he is grappling with the central problems of harmonic science. One agrees with Rameau, as well as with his remark, which he makes in the *Démonstration*,² that some of these problems have never yet been solved. To this we may add that they still await solution.

¹ See pp. 99, 109.

² p. 50.

"TEMPERAMENT: ITS THEORY AND PRACTICE."

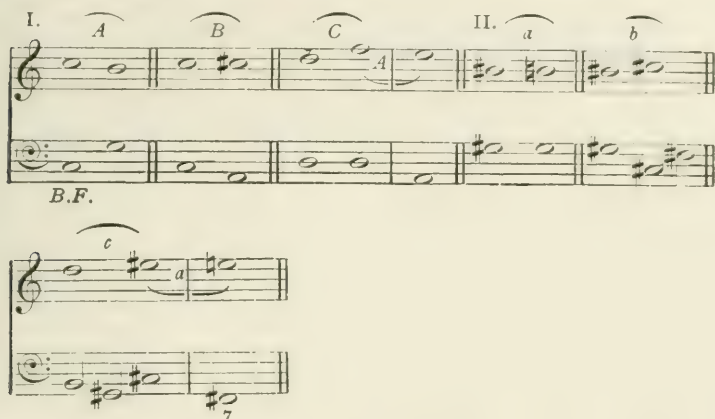
THE presence of "altered consonances" in the *natural* mode leads Rameau, as we have seen, to conclude that temperament in music is a necessity, and one moreover prescribed by nature itself. If Rameau's reasons as to the necessity for temperament are not convincing, nevertheless his remarks in dealing with this subject are of considerable theoretical importance.

In Chapter VII. of the *Génération Harmonique* (*Origin du Tempérament, sa théorie et sa pratique*) Rameau brings forward several extremely interesting propositions. In *Propositions I. and II.*, he asks: "How does the ear distinguish the difference between the major and the minor semitone [that is, the diatonic and chromatic semitone, as *b-c*, *b-#b*], or between the minor Third and the augmented Second?" The answer given by Rameau is, that the ear does not perceive any difference between these intervals on a keyed instrument, except by means of the Fundamental Bass. That is, it is not the slight difference in proportion between the diatonic and chromatic semitones which the ear regards as most important, or of which it takes most account; for the same notes on the Clavecin, as *b-c*, may represent now a diatonic semitone *b-c*, and now a chromatic one, as *b-#b*. It is the harmonic significance or meaning of such intervals which the ear regards as all important, and the slight difference in proportion matters nothing, or at least very little, to the ear, so long as the harmonic meaning of the interval is made clear.¹

"The ear does not perceive the difference between the major and the minor semitone, nor between the minor Third and the augmented Second, except by means of the fundamental succession, of which the harmony is understood, even if it is not actually heard. If the fundamental bass proceeds by Fifths, the ear accepts all the semitones as major, and all the minor Thirds as such. If the fundamental succession changes, and in consequence the *key* changes, the semitone which

¹ *Gén. Harm.*, Ch. 7., Prop. III., IV., and V.

occasions the change will appear to the ear as minor, and the minor Third as an augmented Second."¹ Rameau illustrates this as follows :—



Here the passage in the treble clef at I. is repeated at II., the same keys on the Clavecin being utilised. The various intervals at II., however, affect the ear in a totally different manner from those at I., and this is because the intervals at II. appear in a quite different harmonic aspect. At *A, a*, and *B, b*, we find the same keys on the Clavecin representing now a diatonic and now a chromatic semitone. At *C, c*, we find the same two keys representing first a minor Third, and then an augmented Second.

Rameau also brings forward a proposition by Huyghens :—
“How does one proceed in singing a passage such as the following : *sol — ut — la — re' — sol* ?” Rameau agrees with

24 : 32 : 27 : 36 : 24

Huyghens that if one sings this melody in such a manner as to give to every interval its just proportion, it will be impossible to sing the last *sol* in unison with the first. For, between 27 : 32 we find a minor Third which is a comma (80 : 81) too small, and if this interval is intoned in its just proportion as 25 : 30 (= 5 : 6), then, the intervals which follow being also sung in perfect tune, the last *sol* must appear

¹ *Gén. Harm.*, Ch. 7, Prop. III., IV., and V.

a comma lower, as regards pitch, than the first. Nevertheless, says Rameau, there is no one who does not pique himself on being able to sing the last *sol* absolutely in unison with the first. How is this? "Without doubt, the impression given by the first *sol*, as fundamental, and of its harmony, is retained by the ear up to the end; consequently it guides the voice, *which itself tempers* the consonance in question, or perhaps all of them, so as to arrive at the unison of the first sound. . . . Is it not therefore the Fundamental Bass and its harmony which guides the ear? There is no doubt of it; everything confirms it."¹

In *Proposition V*. Rameau discusses the question as to how the voice is guided in the intonation of different intervals when it is accompanied by one or more instruments. Suppose that it is accompanied by a Viola. In this instrument the Fourths (old tuning) are just, consequently the major Third *c-e* formed by the two middle strings is a comma too large. If now both voice and viola begin on the note *c*, as Tonic, the voice will tune itself to this *c*, as the principal and fundamental sound. But what happens when both voice and viola proceed to *e*: for now they do not accord, as the *e* sung by the voice is different from the *e* played on the viola? Does the voice, then, accommodate itself to the viola, slavishly imitating its intonation, so as to sing every sound in absolute unison with it? By no means. The note *e* is regarded by the voice and ear as part of the harmony of the fundamental sound. The voice therefore intones *e* in its just proportion, regardless of the intonation of the viola. If, however, the key changes so that *e* now becomes Tonic (*e* minor?) the voice will take this *e* in unison with the viola, while *c* will be intoned differently by each.

If we add to this instrument a Violin, tuned in perfect Fifths, so that the major sixth formed by the first and fourth strings is a comma too large, and also a Clavecin, in which there is not a single just Fifth, what happens? Which of these instruments must the voice follow? As each instrument has its own peculiar intonation, the *c* of the one never being absolutely the same as that of the other, and so with an infinite number of other sounds, the Fifths being just here, and the Fourths there, while neither Fourths nor Fifths are

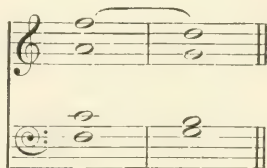
¹ *Gén. Harm.*, Ch. 7., Prop. IV.

just on the Clavecin, how is the voice to proceed amidst such a confusion,—not of imperfect harmony only, but of false unisons? One sees very well that, far from being helped by this confusion of sounds, it is actually in danger of being completely bewildered by such a *fracas*, were the ear not preoccupied in favour of the Fundamental Bass; it is this bass, and its harmony, which guides the ear.¹ Whether actually heard, or only understood, it is to this that the voice tunes itself. It should also be observed that the triple progression, extended to its twelfth term (*c* to *b*♯) gives us “a *Si*♯ which surpasses the first sound *Ut* by a Pythagorean comma” (524288 : 531441). “Temperament, therefore, is in the nature of things a necessity, and of the different kinds of temperament in use, equal temperament is to be preferred to any other, in so much as it permits transposition or modulation to any and every key.”

With the greater part of these remarks of Rameau one has little difficulty in agreeing. If they do not furnish us with much material for a rational theory of temperament, they at least show how it is that temperament is possible, how it is bearable. They also suggest that temperament may not be so great an outrage on the susceptibilities of the ear as Helmholtz and his followers would have us believe. As a matter of fact, the ear will much more readily tolerate an interval slightly out of tune than a faulty harmonic progression. This, however, does not mean that the interval in question would not sound greatly better if it were in tune. Rameau's strongest argument in favour of equal temperament is that it permits of modulation to every key. This is for Rameau, however, only a secondary consideration. The real necessity for temperament he sees in the presence of “altered consonances” in the natural Major Mode. It was bad enough that Rameau, having set out to prove that the Major Mode was a natural product, should find in this mode an “essential fault” in the presence of the tritone and the false intervals which arise in the attempt to fit the Fundamental Bass to this part of the scale, but it was hardly to be supposed that he should discover in these false intervals a proof of the necessity for temperament. In dealing with the extremely interesting proposition of Huyghens, Rameau is evidently of

¹ *Gén. Harm.*, Ch. 7, Prop. V.

opinion that if the interval $la-ut$ be sung in tune, ^{27 : 32} the pitch will flatten. One must however maintain, on the contrary, that this could only happen if the interval *were not sung in tune*. If the interval be sung in tune, and according to its correct proportions, the last key-note will be absolutely in unison with the first. Rameau assumes this interval to be a minor Third, of "altered" proportions. It is, however, not a minor Third, and its proportions are correct. In this case also, Rameau should have remarked. the harmonic succession guides the ear. Thus in the following passage where, between *d-f*, we find an interval of the proportion 27 : 32:—



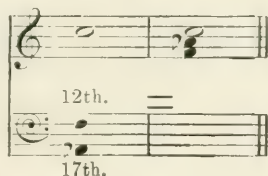
the voice makes no attempt to convert this interval into a minor Third, nor indeed is the singer greatly concerned as to what proportion of interval he forms between the two sounds in question. What he is concerned about is that his first sound should form a perfect Octave with the bass note *f*, and his second sound a perfect Fifth with *g*. If he does this he will form an interval which cannot be regarded as a minor Third. If he does not do this, he will sing out of tune. The voice, then, makes no attempt to perform such a difficult feat as to "temper" the interval *d-f*. Rameau does not succeed in making out a case as to the logical necessity for temperament. Speaking generally, the difficulties in the way of just intonation for keyed instruments are practical; not theoretical. The reverse is true of equal or any other system of temperament.

CHAPTER VIII.

RAMEAU'S *GÉNÉRATION HARMONIQUE* AND *DÉMONSTRATION* DU PRINCIPLE DE L'HARMONIE.—(continued.)

THE MINOR HARMONY.

IN the *Génération Harmonique*, we find that Rameau has radically altered his views respecting the origin of the Minor Harmony. He no longer considers the minor harmony to be derived from the same principle as the major. If the major harmony has its source in the phenomena of harmonic resonance, the minor harmony, on the other hand, has its source in what is, for Rameau, a new acoustical phenomenon. This is the power possessed by any given sound of exciting co-vibration in the sounds of the Twelfth and Seventeenth below it :—



These sounds when heard simultaneously furnish us with the minor harmony. In the *Génération Harmonique*, Rameau imagines that the sounds of the Twelfth and Seventeenth below actually vibrate, that is, that the sonorous bodies to which they correspond vibrate throughout their whole length. In the *Démonstration*, however, he perceives his error. The sonorous bodies in question do not vibrate in their totality, but only in segments: the first (12th) in three, and the second (17th) in five segments. Each of these segments corresponds to the *Unison* of the exciting sound C. That is, the sounds of the Twelfth and Seventeenth below

do not co-vibrate at all, but only the Twelfth (third partial tone) of this Twelfth, and the Seventeenth (fifth partial tone) of this Seventeenth. This radically alters the situation for Rameau. Nevertheless he adheres, at least in the first part of his *Démonstration*, to his theory as to the origin of the minor harmony given in the *Génération Harmonique*.

In the *Démonstration* he thus succinctly states his case for the minor harmony:—"If one tunes with the principal sound other sonorous bodies which are in the same proportion to it as the sounds which it produces [by its resonance], namely, the Twelfth and Seventeenth above, and the Twelfth and Seventeenth below, it will cause them all to vibrate: with this difference, that the former will vibrate throughout their whole length, whereas the latter will divide themselves into parts, which correspond to the Unison of the principal sound. . . . These experiences are equally sensible to the ear, to the eye, and to the touch. From this power of co-vibration which the principal sound exercises on its multiples

$$\overbrace{\quad\quad\quad}^{17\text{th}}$$

arise these proportions: — $\frac{5}{12} \frac{3}{5} \frac{1}{3}$ $\overbrace{la^2 - fa - ut}^{12\text{th}}$ which, reduced to their

smallest terms and applied to string-lengths, give:—

$$\overbrace{\quad\quad\quad}^{5\text{th}}$$

$\underbrace{fa - la^2}_{\text{Min. 3rd.}} - \underbrace{ut}_{\text{Maj. 3rd.}}$ ¹ That is, the principal sound *Ut*, or C, is

considered to be the generator, or at least the determining sound, of both the major and the minor harmonies; the first resulting from its resonance, the second from its power to produce co-vibration in the Twelfth and Seventeenth

below, thus: — $\underbrace{a^2 - f}_{\text{Min. harm.}} - \underbrace{C - g - c}_{\text{Maj. harm.}}$

The principal and central sound C appears therefore to determine a harmony in both directions; a major harmony upwards, corresponding to the harmonic proportion, and a

¹ *Démonst.*, pp. 21, 22.

minor harmony downwards, corresponding to the arithmetical proportion. But the principal sound C must not therefore, according to Rameau, be regarded as the fundamental sound of both harmonies. While then in the case of the major harmony C-*e*-g the fundamental sound is C, in the case of the minor harmony f-*a*^b-C the fundamental note is not C, but f. Rameau's explanation of this is as follows:—"As in the resonance of a sonorous body it is only the sounds which correspond to the harmonic proportion which strike the ear, this [proportion] is the only one by which we ought to be guided; consequently everything ought to be subordinated to it. Thus since the grave and predominating sound of a sonorous body is always, in the judgment of the ear, the fundamental sound, it is necessary to suppose that the same will be the case in the arithmetical proportion."¹

Therefore, "in the harmonic proportion [major harmony] it is the *major Third* which is directly related to the fundamental sound; whereas in the arithmetical proportion [minor harmony] it is the *minor Third* which is thus related."²

The proportions of both major and minor harmonies may be expressed by the same numbers: the proportions of the major harmony = 4 : 5 : 6; those of the minor harmony are expressed by the same numbers in inverted order = 6 : 5 : 4. Rameau remarks that his use of these proportions is not arbitrary; he derives them from a natural principle, namely, the physical properties of the sonorous body itself. The minor harmony, however, Rameau considers to be less perfect than the major. The major harmony is the "direct product of Nature," whereas the minor harmony is only "*indicated by Nature*," and is, in a sense, the result of Art. In all questions relating to harmonic succession, modal relationship, etc., it ought therefore to be subordinated to the major harmony, and be regulated by it. For the same reason the lowest note of the minor harmony should be regarded as the fundamental note. "The principal sound *Ut*," says Rameau, "which, through the direct operation of Nature, produces the Major Mode, indicates at the same time to Art the means of forming a Minor Mode. This difference between the work of Nature itself, and that which Nature is content merely to indicate, is well marked, in that this principal sound *Ut* itself produces

¹ *Gén. Harm.*, Ch. 3.

² *Ibid.*

the major harmony directly by its resonance, whereas it only causes a certain vibration or tremor (*frémissement*) in those foreign bodies which are related to it in the arithmetical proportion (*genre mineur*). . . . But this indication having been given, Nature then reassumes her rights; she desires, and we cannot avoid this conclusion . . . that the generator, as the originator (*fondeur*) of all harmony and harmonic succession, should be here the law-giver."¹

So then, Rameau, after having strenuously opposed, in his *Traité*, Zarlino's explanation of the minor harmony, finally adopts it in the *Génération Harmonique*.

We have seen that Zarlino, like Rameau, considered the minor harmony to be somewhat less perfect than the major. The minor harmony is somewhat mournful in character (*mesta*): while the major is bright and lively (*allegra*). Once more we find Rameau taking up the position that because a thing is natural, it must necessarily also be perfect and beautiful; while on the other hand that which is the result of art, the product of man himself, is necessarily imperfect. Rameau should have explained more fully in what sense he understands the term "natural," and also why it is that he considers that the introduction of the human element is necessarily bound to result in something imperfect. But although he may not adopt the best method of proving his conclusions, it by no means follows that these conclusions are wrong in themselves. His opinion as to the comparative inferiority or imperfection of the minor harmony accords not only with that of Zarlino, but of Helmholtz and other theorists. He perceives quite clearly what is an undoubted natural fact, namely, that the harmony which results from the primary constituents of a compound musical tone is, and can only be, a *major* harmony. In this sense, the harmony of Nature is a major harmony, and it can never be a minor one. Such a statement does not differ essentially from that of Zarlino: for if we place, for example, above the note *c* a major Third *e*, and a perfect Fifth, *g*, we find, as Zarlino had said, that "these consonances are in their natural places": they are both constituents of the compound tone of *c*: whereas, if we substitute for the major Third *e*, the minor Third *eb*, which gives the minor harmony *c-eb-g*, we find that *eb* is a foreign sound, and

¹ *Démonst.*, pp. 62-64 (Du Mode Mineur).

has no part in the compound tone of c . It is, in a sense, a contradiction of nature; it stands, and must stand, in perpetual contradiction with the sound c , which is, indeed, actually present in, and cannot be separated from, the compound tone of the fundamental c .

Rameau now perceives that while the major harmony corresponds to the harmonic progression of numbers $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}$ the minor harmony corresponds to the arithmetical progression $\frac{5}{6}, \frac{4}{6}, \frac{3}{6}, \frac{2}{6}, \frac{1}{6}$. Or, while the major harmony may be represented by the proportions $4 : 5 : 6$, the proportions of the minor harmony correspond to the same numbers in inverted order, thus, $6 : 5 : 4$. He, however, expressly disclaims attaching any special significance to these numbers and proportions. In themselves they determine nothing, but are themselves determined by the physical properties of the sonorous body. Here perhaps Rameau, after his somewhat reckless use of proportions in the *Traité*, has become over-cautious, and errs in the other direction. For it is something to have it definitely established that the major and the minor harmonies correspond to these proportions: and a maker of musical instruments, if it were part of his duties to manufacture major and minor harmonies, and not only individual strings, pipes, tubes, etc., would make use of these proportions, without inquiring very closely as to whether his procedure were theoretically defensible or not. But when it is discovered that the same proportions which, applied to a sonorous body, or several sonorous bodies, produce the major harmony, produce also in inverted order the minor harmony, we are presented with a fact which may not only be of service to a maker of musical instruments, but which may and does influence, to a very considerable extent, the whole theory of harmony. In so far as the question is one of proportion, the minor harmony must be regarded as an inverted major harmony.

Nevertheless, from a theoretical as well as a physical point of view, the question bristles with difficulties. One of these is, which of the three different sounds which compose the minor harmony is to be regarded as the fundamental note? Rameau proceeds here in a quite arbitrary way. He determines the lowest note of the harmony as the fundamental note; but can give no better reason for this than that the minor harmony must "conform to the law" laid down by the major

harmony. Nevertheless, we have seen that he generates both harmonies $\widehat{f-ab} \cdot \widehat{C-e-g}$ from a single sound. It is enough for Rameau that he feels, as does every musician, that the fundamental note of the minor harmony is the lowest note of the chord. Further, Rameau overlooks the important fact that other sonorous bodies than those of the Twelfth and Seventeenth below the principal sound may be, and are, affected by the resonance of the principal sound. So that the same difficulty occurs with the minor as with the major harmony.¹ But, as we have already seen, these multiples of the principal sound are not excited into co-vibration at all, but only such of their upper partial tones as correspond to the Unison of the exciting sound. It is Rameau's ultimate recognition of this fact which induces him, in the latter part of the *Démonstration*, to propose *an essentially different explanation of the origin of the minor harmony*. This he treats of in connection with the relationship between the Major and Minor Modes.

THE MINOR MODE.

Rameau considers that the Minor Mode should, in everything except its origin, conform to the rules laid down for the Major Mode. It must therefore be subordinated to the harmonic proportion, and although the minor harmony has been generated downwards (arithmetical proportion) the lowest note of the harmony must nevertheless be regarded as the fundamental note. One reason which Rameau advances for this is that "the ear so decides,"—a very good reason, but not a scientific one. Also the Minor Mode, like the major, must be considered to be determined by a Fundamental Bass of three terms, and must likewise submit to the operation of "double employment." As, in the Major Mode, each term of the Fundamental Bass has above it a major harmony, it might be expected that in the Minor Mode each of the fundamental sounds should have a minor harmony. This does actually occur, but only in the *descending* form of the scale, and this form Rameau describes as the "primitive order"

¹ See pp. 158-164.

of the mode. In the *ascending* form of the scale, a minor harmony cannot be placed on each of the sounds of the Fundamental Bass. "We will suppose at present that each of the fundamental sounds of the new mode bears a minor Third, in this order of proportion 10 : 12 : 15, without concerning ourselves whether this order is found at 27 (the Subdominant) or any other number, whatever it may be, especially as *temperament*, which we have seen to be a necessity, enables us to dispense with this inquiry."¹

But as a leading-note is necessary in the minor no less than in the major mode, "in consequence of the close (*repos*) it announces on the Tonic, which follows it," the Dominant must have a major harmony. Also, in the ascending scale, the sixth degree must be raised a semitone : this is necessary "in order to procure a diatonic succession, for without it there would arise an interval of a tone and a half, while the largest diatonic interval is only a tone." The only form of the minor scale investigated, therefore, is that of our melodic minor scale, ascending and descending. The Fundamental Bass of this scale is as follows :—

B.F. 81 : 243 : 81 : 27 : 81 : 729 : 243 : 81

81 : 243 : 729 : 243 : 243 : 81 : 243 : 81

In the descending scale we find that at *d* the fundamental bass has a minor harmony, while at the note *b* it has a major one. The reason for this, Rameau tells us, is that "as in the

¹ *Gén. Harm.*, Ch. 12.

proportions 81 : 243 : 729 the central term 243 appears as Tonic of the mode, the harmony must be minor, while immediately after 729 it reassumes its major harmony in order to announce the real principal sound ($\begin{smallmatrix} 81 \\ e \end{smallmatrix}$) which follows it."

Still more extraordinary is his explanation of the diminished Fifth, which appears at the note *c* \sharp . "At 729 we find," he remarks, "a false Fifth, instead of the perfect Fifth, which rightly belongs to the fundamental; but note well that it [729] always represents in the mode the harmony of the Subdominant [that is, by virtue of "double employment"] whose minor Third naturally forms [when placed above *f* \sharp] this false Fifth; then as the Dominant 243, which follows it, has no longer the character of principal sound, but reassumes its own character as Dominant, 729 is obliged to conform to the original rules of this mode, since the diatonic succession offers no further obstacle" [!].¹

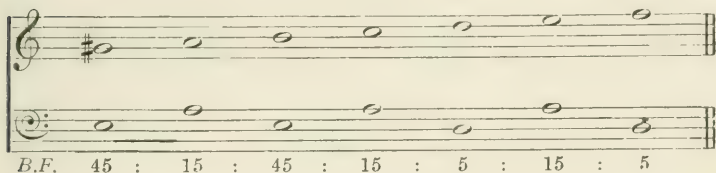
In this connection we are now better able to understand Rameau's remark that the necessity for temperament enables us to dispense with too close an inquiry as to the nature of the harmony which, in the minor mode, each of the fundamental sounds ought to bear. So highly does he think of temperament that it apparently reconciles him to the discrepancy of an entire semitone, so that a diminished Fifth may take the place of a perfect Fifth. One can also well appreciate the force of his remark, towards the close of his examination of the minor mode:—"This minor mode has many peculiarities which should not be overlooked; they are due to the imperfection of its origin."² No doubt the minor mode has some peculiarities; but these are not so peculiar as Rameau's methods of dealing with them.

In the *Démonstration* Rameau devotes considerable space to the further investigation of the Minor Mode. "I have not thought it proper to pass over in silence the Minor Mode," he remarks, "as has been done by all the authors who have treated of the theory of music." He endeavours to prove that in making the Minor Mode conform to the Major he is not proceeding arbitrarily. For this subordination of the minor to the major harmony and mode is indicated by Nature herself: for the sonorous body, in causing its multiples

¹ *Gén. Harm.*, Ch. 12.

² *Ibid.*

(12th and 17th below) to co-vibrate, does not make them vibrate throughout their whole extent, but only in segments, each of which corresponds to the *Unison* of the exciting sound. Thus Nature only *indicates the possibility* of the minor harmony.¹ Rameau, in the *Démonstration*, omits the descending form of the melodic minor scale, with its Fundamental Bass; but instead he gives another scale, ascending, beginning with the leading-note, thus:—



(Here *c* 45 is the major Third of *c*-9, which is the Tonic of the major scales given in the *Démonstration*.) He is not, however, disposed to admit this as a possible form of the minor scale. "The succession from *fa* to *sol*# [*f*-*g*#] is not diatonic, nor is it natural to the voice; in order to remedy this defect, and at the same time add to the beauty of the melody, it is necessary to raise *fa* a semitone. This, however, is a matter simply of melody, and the harmony does not suffer."²

On the other hand, the Dominant must always have a major harmony. Indeed, Rameau is of opinion that if

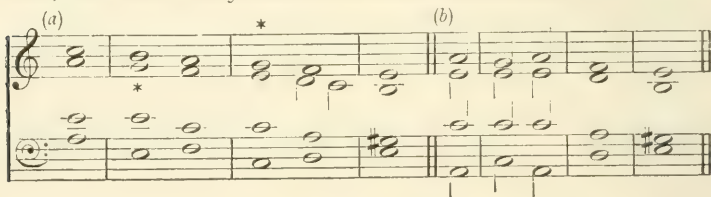
¹ "On ne peut donc supposer la résonnance des multiples dans leur totalité, pour en former un tout harmonieux, qu'en s'écartant des premières loix de la nature : si d'un côté elle indique la possibilité de ce tout harmonieux, par la proportion qui se forme d'elle-même entre le corps sonore & ses multiples considérés dans leur totalité : de l'autre elle prouve que ce n'est pas là sa première intention, puisqu'elle force ces multiples à se deviser, de manière que leur résonnance, dans cette disposition actuelle, ne peut rendre que les Unissons, comme je viens de le dire ; mais ne suffit-il pas de trouver dans cette proportion l'indication de l'accord parfait qu'on en peut former ? La nature n'offre rien d'inutile, & nous voyons le plus souvent qu'elle se contente de donner à l'Art simple indications, qui le mettent sur les voyes." (*Démonst.*, pp. 65, 66.)

² *Démonst.*, pp. 77, 78.

sol♭ (*g*♭) is substituted for *sol*♯, then the mode becomes major. He remarks:—"If we descend in the Minor Mode, thus: *La, sol, fa, mi* [*a-g-f-e*, A minor], etc., we modulate to the Major Mode, from which the minor is derived; for all the diatonic difference between these two modes consists in the *sol*♭ or *sol*♯; not that in practice one has not the art of preserving the impression of the Minor Mode with *sol*♭; but this is effected by the help of a dissonance, which cannot be avoided." The dissonance referred to here is the diminished Fifth, which occurs at the term 729 in the melodic minor scale (see p. 226).

But in order to preserve the impression of the Minor Mode in such a case, Rameau concludes that the most satisfactory way is to abolish the *sol*♭ altogether. "There is, then, only one means of preserving in descending the impression of the Minor Mode, namely to exclude *sol*♭ from the harmony, and to use it simply as a melodic ornament *pour le goût de chant*) as well as may be."¹

But it cannot be said that there is any difficulty in the following passages in regarding the *g*♭ as a real harmonic note; it is certainly not a passing or auxiliary note, nor indeed, any kind of ornamental melodic note:—



Both passages are throughout in A minor. It would be rash, however, to conclude from this that our minor key-system has been evolved, not from harmony, but from melody, that it has as its real basis an old Church mode (the Æolian) and that the other forms of the minor scale are merely "chromatic alterations" of this old mode. On the other hand Rameau, as is proved by his remarks concerning the *g*♭, is unable to find a Fundamental Bass for such a passage, and is forced to admit it.

Such then is Rameau's explanation of the Minor Mode.

¹ *Démonst.*, p. 77.

If, in treating of the Major Mode, he has encountered serious difficulties, he now finds himself in a truly desperate case. The harmony which the Fundamental Bass should bear may be major, or minor, or even diminished—notwithstanding his express refusal, even in the *Traité*, to accept this last chord as fundamental—according to circumstances. One and the same fundamental sound may even at one time bear a major harmony, and at another time a minor one. As in the major, one kind of bass is necessary for the ascending form of the scale, and another for descending; it is, like the major, in two keys, and it is necessary also to make use of the weak device of “double employment.” The net result, however, of Rameau’s investigations is that we are left without any form of the minor scale whatever. For as the Subdominant must have a minor harmony *d-f-a*, *f*♯ cannot be regarded as an essential note of the scale: for the same reason the “harmonic” form of the scale must be rejected, for there arises the augmented second *f-g*♯, which is not a diatonic interval. Finally, *g*♭ has no place in the minor scale, but can only occur in that of the relative major. But if Rameau finds himself baffled by the difficulties of the Minor Mode, theorists since his time have fared little better.

FURTHER DEVELOPMENT OF RAMEAU’S VIEWS RESPECTING THE MINOR HARMONY: RELATIONSHIP OF THE MAJOR AND MINOR MODES.

The relationship between the Major and Minor Modes is, Rameau considers, to be explained in the same way as scale-or key-relationship in general. “It has already been observed that, unless dissonance is made use of, two terms of this [triple] progression being given, the third is arbitrary: thus

$\begin{smallmatrix} 3 & 9 \\ \text{sol} & - \text{re}' \end{smallmatrix}$, being given, the third term may be either $\begin{smallmatrix} 1 \\ \text{ut} \end{smallmatrix}$ or $\begin{smallmatrix} 27 \\ \text{la} \end{smallmatrix}$;

so that in this order $\begin{smallmatrix} 1 & 3 & 9 \\ \text{ut} & - \text{sol} & - \text{re}' \end{smallmatrix}$, *sol* may be considered as

Principal, or Tonic: whereas in $\begin{smallmatrix} 3 & 9 & 27 \\ \text{sol} & - \text{re}' & - \text{la} \end{smallmatrix}$, *ré* is the Principal.”¹

¹ *Gén. Harm.*, Ch. 13.

Between the two principal sounds *sol* and *ré*, therefore, a close relationship exists. If we compare the two modes, or keys, represented respectively by the fundamental sounds $1 : 3 : 9$ and $3 : 9 : 27$, it will be observed that 3 and 9, with the harmonies they bear, occur in both keys; "whence it follows that these terms, representing, as they do, fundamental sounds, the more there are sounds in common between these two modes, the more closely will they be related to each other."¹

This is the explanation of the close relationship which exists between the Major and Minor Modes. In the descending (*Melodic*) minor scale we find exactly the same sounds as in the relative major. It is true that the relationship between the Tonic of a major key and that of its relative minor is that of a minor Third, which is not so perfect as a Fifth-relationship, but this is compensated for by the large number of sounds they possess in common. "The great number of harmonic sounds common between these two modes . . . removes the defect as respects the relationship of their fundamental sounds." The transition from a Major to its relative Minor Mode is effected by means of the Fundamental Bass descending a minor Third. "This relationship of the major to the minor mode introduces a fundamental succession in Thirds." One also observes that "the Dominant and Subdominant being obliged to conform in their harmony to the nature of the mode from which they derive their origin, it follows that every mode [key] which is the Fifth of another should be of the same species [*genre*, that is, major or minor]; whereas, on the other hand, because of the relationship of the major with the minor mode, every mode which is a Third from another ought to be of a different species." Thus, if C major be taken as the central key, the two keys F and G, each of which has a Fifth relationship with C, ought to be major: while the keys of E and A, which are a Third above and below C, ought to be minor.

Rameau's explanation of the relationship between the Major and the Minor Modes has been repeated in countless text-books of harmony up to the present day. Such an explanation, no doubt, has served to a considerable extent a practical purpose. But if it be the case that the degree of

¹ *Gén. Harm.*, Ch. 13.

relationship between two scales or keys is determined by the number of sounds they possess in common, then how is it that, taking C major as a central key, E major with four sharps is more closely related to C than D major, with only two sharps : while A \flat major, with four flats, is more closely related to C major than B \flat major, with two flats ?

NEW THEORY OF THE MINOR HARMONY AND MINOR MODE : ANTICIPATION OF HELMHOLTZ'S THEORY OF THE MINOR HARMONY.

In the latter part of his *Démonstration*, Rameau devotes considerable space to the further investigation of this relationship, as well as of the minor harmony and mode. It would appear that he was not completely satisfied with the position in which matters had been left in the *Génération Harmonique*. Besides, he was no doubt somewhat puzzled by the defective relationship existing between the Tonics of two modes otherwise so closely related to each other as a major mode and its relative minor. He had himself suggested that such a relationship was at least as close as a Fifth relationship, as that of a Dominant or Subdominant. If the origin of both the major and minor harmonies was to be found in a single sound, C for example, then this C must form the central point of both harmonies, with its major Third and perfect Fifth below as well as above it : and the relationship of these harmonies must appear as $f-a\text{?}-C-e-g$, where f , as fundamental note of the minor harmony $f-a\flat-c$, must be regarded as the Tonic of f minor. But Rameau was too good a musician to attempt to represent f minor as the relative minor of C major. Nevertheless these considerations must have frequently presented themselves to him.

Further, he has now become alive to the fact that the multiples of the principal sound (Twelfth and Seventeenth below) do not vibrate in their totality. He therefore examines afresh the acoustical phenomenon on which his theory of the minor harmony and Minor Mode is based, and now actually tells us that it is impossible to derive the minor harmony from the co-vibration of the multiples of the Twelfth and Seventeenth !

Such a proceeding could only be justified if these multiples, instead of vibrating in segments, vibrated throughout their whole length, and instead of reproducing the fundamental tone of the exciting sound (the unison) produced *their own fundamental tone*, corresponding to the entire length of the string.¹

Rameau, then, expressly states that the co-vibration of the multiples has no basis in fact, and that therefore it cannot serve as the basis of the minor harmony. But let it be supposed, he proceeds, that these multiples did co-vibrate in their totality, *would not this be a manifest contradiction of Nature*, and of the principles which she has already established in the harmonic resonance of the sonorous body? The multiples, however, do not co-vibrate, but only those segments which correspond to the unison of the exciting sound, and the utmost that can be deduced from such a fact is that Nature here *indicates the possibility of the formation of the minor harmony*.² So much then is clear; the minor harmony cannot have its origin in a phenomenon which does not exist, and which, if it did exist, would be a contradiction of the first principles of Nature: the minor harmony must arise from some other source.

But what other source is there? There is but one; the harmonic resonance of the sonorous body. "What," he asks, "does Nature indicate? She indicates that the principle which she has once for all established shall, and must, dominate everywhere, and that everything—harmony, mode, melody, etc., must be related and subordinated to The generator of the major harmony C-c-g must, therefore,

¹ "Pour former un accord parfait où le genre mineur ait lieu, il faut supposer que les multiples résonnent & qu'ils résonnent dans leur totalité, au lieu qu'en suivant l'expérience que j'ai rapportée, ils ne font que frémir, et se divisent" . . . etc.—(*Démonst.*, p. 64.)

² "On ne peut donc supposer la résonnance des multiples dans leur totalité, pour en former un tout harmonieux, qu'en s'écartant des premières loix de la nature: si d'un côté elle indique la possibilité de ce tout harmonieux, par la proportion qui se forme d'elle-même entre le corps sonore & ses multiples considérés dans leur totalité, de l'autre elle prouve que ce n'est pas là sa première intention."—(*Ibid.*, p. 65.)

³ "Ce que prétend la nature? Elle veut que le principe qu'elle a une fois établi, donne par tout la loi, que tout s'y rapporte, tout lui soit soumis, tout lui soit subordonné, harmonie, mélodie, ordre, mode, genre, effet, tout enfin."—(*Ibid.*, p. 67.)

also be the generator of the minor harmony. For the reasons already given, this minor harmony cannot consist of the sounds $f\text{-}a\flat\text{-}c$. But there is still another reason. If C is the determining sound, the generator, of the minor harmony $f\text{-}a\flat\text{-}C$, how can f possibly be regarded as the fundamental note? This difficulty has at length been realised by Rameau. Nevertheless he is convinced that f , the lowest sound of the harmony, is in reality the fundamental note. But then, the harmony which nature places above every fundamental note is a major harmony: in this harmony the Third is major. How is the minor Third to be derived? this minor Third which determines the Minor Mode just as truly as the major Third determines the Major Mode.

Rameau now concludes that the minor harmony determined by the principal sound C is not $f\text{-}a\flat\text{-}C$, but $a\text{-}C\text{-}e$. Here the difficulty as to the generation of the minor Third disappears, for the minor Third is represented by C , the principal sound itself! The sound e , which is Third of C , is also Fifth of a . This sound a must therefore be also regarded as a generator. "The Mode" (major mode), remarks Rameau, "has already been established: it is beyond our power to change it in any way. . . . But it is possible to *vary* it by the new *genre* in question [minor mode]. . . . This variety is determined by the quality of the Third which appears above the fundamental sound, or generator. This generator has already determined its [major] mode, by means of its *major* Third, which sounds along with it; it equally determines a new mode by forming a *minor* Third, while still retaining its character as the principle [or generator]. . . . This admits of the most positive proof. The major Third alone is actually generated from the fundamental sound: never a minor Third, which, nevertheless, we suppose to be related to this fundamental sound. It is then necessarily this minor Third itself which is the cause of the difference of effect between major and minor." ¹

¹ "Cette variété va devenir la cause des différens effets entre les Modes, qui en seront susceptibles. Elle existe dans la tierce directe du générateur. Ce générateur a déjà déterminé le genre de son mode, par sa *tierce majeure*, qu'il fait résonner, il va pareillement déterminer celui d'un nouveau mode, en formant, lui-même, une *tierce mineure* directe, sans cesser d'être principe. Je dis, sans cesser d'être principe, parce que, dans ce cas, le produit, ou censé tel, est la seule cause de l'effet: la preuve en est certaine. (*Démonst.*, p. 69.)

Rameau here says that the fundamental sound generates a major Third, but can never generate a minor one; in other words, the *klang* which constitutes an inherent property of the sonorous body is always major. This fundamental sound "can never be the cause of a direct minor Third" which is supposed to be directly related to the fundamental sound.¹ Thus in the minor harmony *a-c-e*, *c*, the minor Third above *a*, cannot be related directly to *a*. In the words of Helmholtz, *c* must be regarded as a foreign tone which has no part in the *a* *klang*.

When we remember the position taken up by Rameau in the *Génération Harmonique*, and in the first part of the *Démonstration* itself in respect of the generation of the minor harmony, this new departure must appear extraordinary. But still more extraordinary is to follow. For in the minor harmony, *a-c-e*, Rameau regards *a* as a fundamental and generator, not of the "foreign" tone *c*, but of the fifth *e*; while, as respects the tone *c*, he explains this exactly as we shall see Helmholtz does: both *c* and *e* he considers to be constituents of the *c* *klang*. From this point of view the sound *a* must appear as a sound added to the *c* *klang*, for it is not a constituent of this *klang*. "Thus," he proceeds, "the ear indicates in this case the method of procedure of the original generator *ut* [*c*]: it chooses for itself a fundamental sound, which becomes subordinate to it, and to which it gives all that is necessary in order to make it appear as a generator. In forming the minor Third of this new fundamental sound, which must be the sound *la* [*a*], the generator *ut* gives to it its major Third *mi* [*e*] for Fifth; Fifth which, as we have already seen, constitutes the harmony and determines the proportion on which depends all fundamental succession of the mode. Thus this new fundamental sound, which may therefore be regarded as generator of its mode [!], is a subordinate one: it is

¹ "La seule tierce majeure directe résonne avec le son fondamental: il est conséquemment la cause de son effet: conséquemment encore il ne peut plus l'être d'une tierce mineure directe qu'on lui suppose: ce sera donc nécessairement de cette tierce mineure même, que naîtra la différence de l'effet entre elle et la majeure."—(*Démonst.*, p. 70.)

forced to submit in every case to the law of the first generator."¹

Rameau, then, is the first to present us with this important theory of the minor harmony, and the Minor Mode. It is not only an entirely new theory, but one which is directly opposed to that of the *Génération Harmonique*, and the first part of the *Démonstration*. The considerations which have influenced Rameau in his remarkable change of front are not difficult to find, nor to understand. With regard to the minor harmony, Rameau has from the first, even in his *Traité*, maintained that the lowest note of the harmony is the fundamental note, and he is still of this opinion when, abandoning his earlier explanation of the minor harmony, he derives it from the arithmetical proportion determined by the co-vibration of the multiples of the Twelfth and Seventeenth. But he has evidently seen that the difficulties, especially that connected with the fundamental note, are too great. He therefore abandons this theory of the origin of the minor harmony, and seeks to explain it in the same way as the major harmony: that is, as arising from the harmonic proportion, from the upper partial tone series. But here a new difficulty presents itself, in that the sound *c* of the minor harmony *a-c-e* is not a constituent of the compound tone of *a*. Rameau, however, regards *c* as itself a generator. The minor harmony therefore has two generators. The sounds *c-e* are constituents of the compound tone of *c*, while this same sound *c* "gives to *a* all that is necessary in order to make it appear as a generator," namely, its major third *e*, which then appears as fifth of *a*. In short, to use the language

¹ "Aussi l'oreille indique-t-elle clairement les opérations du principe générateur *Ut* dans cette circonstance: il s'y choisit, lui-même, un son fondamental, qui lui devient subordonné, & comme propre, & auquel il distribue tout ce dont il a besoin pour paroître comme générateur. En formant la tierce mineure, de ce nouveau son fondamental, qu'on juge bien devoir être le son *la*, le principe *Ut* lui donne encore sa Tierce majeure *mi* pour *Quinte*, *Quinte* qui, comme on le sçait à présent, constitue l'harmonie, & ordonne de la proportion sur laquelle doit rouler toute la succession fondamentale du Mode: ainsi ce nouveau son fondamental, qu'on peut regarder, pour lors, comme générateur de son Mode, ne l'est plus que par subordination: il est forcé d'y suivre, en tout point, la loi du premier générateur."
—(*Démonst.*, pp. 71, 72.)

of Helmholtz, the sounds $c-e$ are constituents of the compound tone of c ; while $a-e$ are constituents of the compound tone of a .

This is exactly the position taken up by Helmholtz in his explanation of the minor harmony; except that Rameau, unlike Helmholtz, gives one of the generators of this harmony the predominance over the other. It is not surprising that this new explanation of the minor harmony should have been imperfectly understood by the French academicians, who supposed it to have reference merely to the relationship existing between the Major and Minor modes. Rameau himself could have been under no such delusion, for he had started with the express statement that the co-vibration of the multiples, having no basis in fact, could not possibly be the source of the minor harmony. The real significance of Rameau's statements was, however, ultimately recognized by D'Alembert, who had himself been mainly responsible for the report dealing with Rameau's theory inscribed in the records of the Academy. While in the first edition of his work, *Eléments de Musique, suivant les Principes de M. Rameau*, D'Alembert had considered the co-vibration of the segments of the multiples to form the proper physical basis of the minor harmony, in the new edition he abandons this view and explains the minor harmony $a-c-e$ as having a two-fold foundation: e is Third of c and Fifth of a . It is surprising, however, that these facts should have escaped the attention of Rameau's commentators, especially of Dr. Riemann, who, in his *Geschichte der Musiktheorie* and other works, demonstrates the superiority of Rameau's claims as a theorist, as compared with Helmholtz, in that he explains the minor harmony as arising from the "under-tone series," whereas Helmholtz, on the contrary, will have nothing to do with any real or supposed series of "under-tones."¹

It is remarkable that Rameau should present us, and in one and the same work, with just those two theories of the minor harmony, the respective merits of which in our own day have occasioned so much controversy and divided theorists into two opposite camps. Whichever view we take there are difficulties. Rameau found himself obliged to abandon

¹ See pp. 387-390.

his explanation of the minor harmony as arising from the arithmetical proportion because, to say nothing of the serious difficulty in connection with the fundamental note, he had discovered that the supposed series of "undertones" was a mere chimera; in reality it was only the upper partial tone series over again. But in his new theory the difficulties are even greater. For here we find not one fundamental note, but two; the note regarded by Rameau himself, and by the vast majority of musicians since his time, as the real fundamental note of the minor harmony appears as an added and foreign tone, derived from no one knows where. Unfortunately for Rameau, who has set out to demonstrate to us that everything in harmony is derived from a *single* generator, the further he proceeds the more difficult does it appear for him to avoid deriving most things in harmony from *two* generators. This ruling idea of Rameau, that everything in harmony is evolved from a single sound, is truly a splendid conception. Everything has its source in Unity, and cannot be properly understood apart from this Unity. But it is an idea which, if realizable, is certainly not realized by Rameau.

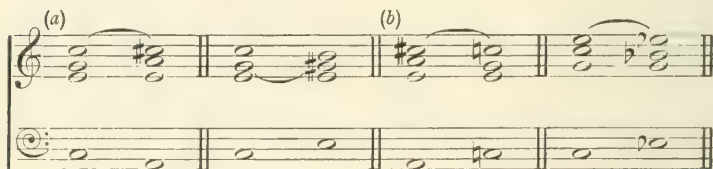
The minor harmony, no less than the major, impresses the ear and the mind as a *harmonic unity*; Rameau's explanation of it as arising from two generators makes of it virtually a dissonance; even the most mechanical of musical theorists would look askance at a proposal to apply the "double-root" theory to a consonant chord. Finally, Rameau does not observe that in abandoning the arithmetical

proportion, $\left(\overbrace{f \text{ — — } C}^{\text{arithmetical}} \overbrace{C \text{ — — } g}^{\text{harmonic}} \right)$ he demolishes his theory

of the Subdominant. It is left without a foundation. Yet we must believe that in making use of the arithmetical proportion he was influenced quite as much by the necessity to find a theoretical foundation for the Subdominant, as to provide an adequate explanation of the minor harmony. It is not, therefore, surprising to find that in his last important work on harmony Rameau seeks for the Subdominant a fresh explanation, and derives it from the sounds of the harmonic series (see pp. 265-266).

THE CHROMATIC GENUS: ORIGIN OF THE CHROMATIC SCALE.

Thus far, remarks Rameau, we have not spoken of the Fundamental Bass in Thirds, nor have we had occasion to do so (as it finds no place in the diatonic system), "except to demonstrate the connection between the major and the minor modes." "It is from the fundamental bass in Thirds that the chromatic genus derives its origin."¹ If the Fundamental Bass proceeds a major or minor Third above or below a given fundamental sound, there arises a new kind of semitone, namely, the *chromatic* semitone of the proportion 24 : 25, thus :—



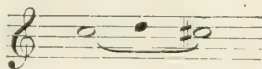
This semitone, which is called *minor* or *chromatic*, because it is a quarter of a tone (125 : 128) less than the major or diatonic semitone, "although a natural one, is not nearly so natural as the latter, and this is proved by experience." It is much more difficult to sing; indeed, few musicians can intone this chromatic semitone accurately, especially in descending. The Fundamental Bass in Thirds introduces a change of key, and should be used only for this purpose. "This chromatic semitone is never used except to change the key, a change which bewilders (*déroute*) the ear."² But the ear is supported by the Fundamental Bass and its harmony, without which it would hardly be possible to intone this chromatic semitone with even a tolerable degree of accuracy. "What assists the musician . . . is, that he unconsciously supports himself by means of the fundamental sound of the new key into which this semitone leads him; otherwise he would find himself as much embarrassed as the merest novice."

¹ *Gén. Harm.*, Ch. 14.

² *Ibid.*

Rameau however subsequently modifies this statement: the singer, he says, may help himself in such a case not only by means of the fundamental bass, but by means of the intervals of the diatonic scale. "Note well then, that in order to form this chromatic semitone one is aided without being conscious of it *either* by the natural intervals, as the tone or the diatonic semitone, *or* of the fundamental succession which occasions it."

Thus, in order to intone the chromatic semitone $c-c\sharp$,

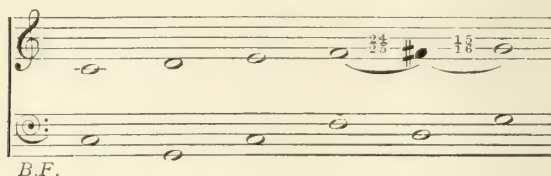


one may first ascend to d , the whole-tone above c , and immediately thereafter descend to $c\sharp$ by means of the diatonic semitone $d-c\sharp$.¹ But here Rameau gives away his case: for the chromatic semitone $c-c\sharp$ (key of C major) thus obtained, is not of the proportion 24 : 25. It is a larger interval of the proportion 128 : 135, and is the result of the difference between the whole-tone $c-d$ (8 : 9) and the diatonic semitone $c\sharp-d$ (15 : 16). But such an interval cannot result from a Fundamental Bass which descends a minor Third from c to a .

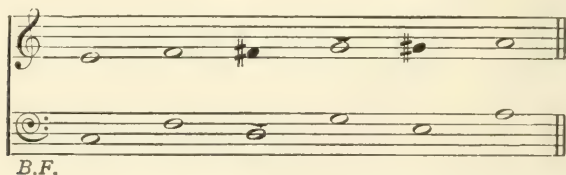
While then it is true that such a bass gives rise to a chromatic semitone of the proportion 24 : 25, it does not follow that our chromatic scale is to be explained in this way. Rameau, however, although he does not attempt to formulate a systematic Fundamental Bass for the chromatic, as he has already done for the diatonic scale, nevertheless implies that not only the chromatic semitone, but also the chromatic scale, has its origin in a Fundamental Bass in Thirds. He cannot well avoid doing so. For, having shown how the species of chromatic semitone in question arises, he has to explain what is to be done with it, that is, how it is employed in harmony. On this point he is quite definite. It is never used except to change the key. Thus "if one intones the passage, *ut-rè-mi-fa-fa\sharp*, the *fa\sharp* cannot be intoned without considerable difficulty"; one reason for which is that

¹ *Gén. Harm.*, Ch. 14, Art. 1.

"at this point the key changes,"¹ that is, a modulation is effected to G major: thus:—



Rameau, however, does not appear to have observed that the *g* thus obtained is not the Fifth of *c*. For this it would be necessary that the interval which succeeds *f-f#* (24 : 25) should be, not the diatonic semitone 15 : 16, but one of the proportion 25 : 27, which is the difference between the chromatic semitone and the major tone *f-g* (8 : 9). But Rameau has already demonstrated, and in the most convincing way, that the only kind of semitone which can arise from the Dominant-Tonic succession is of the proportion 15 : 16. In the same way, if the chromatic scale be extended a little further,

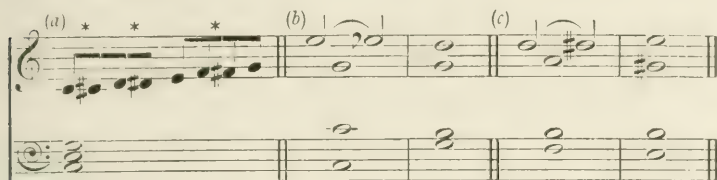


it will be found that, if the chromatic semitones be determined as of the proportion 24 : 25, and the diatonic semitones of the proportion 15 : 16, *g* cannot be considered as perfect Fifth, nor *a* as major Sixth of *c*; that is, as the fifth and sixth degrees of the scale of C major: nor can their leading-notes *f#* and *g#* belong to the chromatic scale of which the diatonic scale of C major forms the basis. In short, Rameau does not observe that in addition to the chromatic semitone 24 : 25, which is the difference between the diatonic semitone and the minor tone 9 : 10, there is the other and larger chromatic

¹ *Démonst.*, pp. 90, 91.

semitone 128 : 135, representing the difference between the diatonic semitone and the major tone 8 : 9, and that, of the five whole-tones of the diatonic major scale, only two are minor.

Nor does he give any adequate explanation of cases such as the following :—



where, as he recognizes, the Fundamental Bass remains stationary. In the first case, the harmony and key are and remain throughout those of C major. Try as he might, Rameau could not invent any Fundamental Bass in Thirds to fit such a passage. For every chromatic note is understood and intoned as a *leading note* to the diatonic note which immediately follows it. Such notes Helmholtz calls “intercalated” or transitional notes, of “no harmonic or modulational significance.” So also with the notes $e\flat$ and $d\sharp$ at (b) and (c), which are frequently described as chromatic passing-notes. Such notes, then, would appear to be melodically, not harmonically, determined. Harmony would therefore appear to have its origin in melody : a doctrine which was, for Rameau, *anathema*, for he quite rightly perceived that it destroyed the very foundation of his system. Rameau, however, might have objected that if the chromatic notes at (a) are in reality leading-notes to the diatonic degrees of the scale which immediately follow, then these notes must have not a melodic but a harmonic determination. For if, for example, $f\sharp$ be correctly intoned as leading-note to g , just as b the seventh of the c major scale is intoned as leading-note to c , then the interval thus formed must be of the proportion 15 : 16, and whether $f\sharp$ be correctly intoned or not it will nevertheless be understood as bearing the same relationship to g as b has towards c , that is, it is its leading-note. But the interval 15 : 16, as Rameau has shown, has a harmonic determination. How could such an interval be melodically, that is arbitrarily, determined? Again, Rameau might have

objected that if the chromatic notes $c\sharp$ $d\sharp$, etc., must be regarded as melodically determined, so also must be the diatonic notes $d\flat$ and $f\flat$, for they also are transitional notes, which do not belong to the harmony $c-e-g$. Might it not even be possible to explain the chord $c-e-g$ itself, not as a harmonic unity, but as a fortuitous combination of melodic notes?

As we have seen, Rameau regarded the chromatic notes of the scale, not as essential elements, or as representing an extension of the key-system, but as a means for effecting a change of key. He lived in an age when "chromatic discords" were much less in evidence than they are at the present day. For Rameau, all chords were diatonic in nature and origin. Thus the chord $f\sharp-a-c-\flat$ could not occur in C major, but must be regarded as the chord of the Dominant Ninth in g minor.

Although the chord of the Augmented Sixth was known and practised in his time (Heinichen gives examples of all three forms of the chord) Rameau avoids entering into any explanation of this chord. Such a chord as the German form of the chord of the Augmented Sixth, for example, $f-a-c-d\sharp$, occurring on the sixth degree of the scale of A minor, must have been for Rameau peculiarly embarrassing. It was impossible for Rameau to explain this chord and its natural resolution on the Dominant, either by means of double "employment" or any other device known to him. It is perhaps for this reason that he avoids the chord for the most part in his works for the stage, and substitutes for it the chord of the Diminished Seventh, which occurs, especially in accompanied Recitative, very frequently. This is accomplished by raising the lowest note of the chord a semitone, thus $f\sharp-a-c-d\sharp$, which chord is then resolved on the Tonic harmony of E major or minor.

In short, the only information which Rameau has to offer with respect to the nature of our chromatic system is that it has its origin in the Fundamental Bass in Thirds, and that such a bass determines the chromatic semitone 24 : 25. This theory of the origin of the chromatic semitone we meet with again in the work of Moritz Hauptmann. Rameau does not mention the fact that all the chromatic notes necessary for the formation of the complete scale of semitones were in use by the fourteenth century, and that even the Greeks had the two forms of B—[$b\flat$ and $b\sharp$.]

THE ENHARMONIC GENUS: THE USE MADE OF
QUARTER-TONES IN MODERN MUSIC.

In addition to the Chromatic, there is also an Enharmonic genus. In the *Génération Harmonique* Rameau's remarks on the enharmonic genus are confined to a single chord, namely, that of the Diminished Seventh. Each of the sounds which compose this chord may in turn, by means of enharmonic change, be regarded as the leading-note of a key: and the chord may therefore appear as diatonic in as many keys as there are notes in the chord. This process, whereby each of the notes of the chord may successively appear as a leading-note may be explained, Rameau thinks, as a new kind of "double employment."¹ He draws an analogy between the chord of the Diminished Seventh, and the discord—the Added Sixth—on the Subdominant. In the chord of the Added Sixth either the Subdominant or the Supertonic may appear as the fundamental note, according to circumstances; in the chord of the Diminished Seventh each of the notes composing it may, in turn, be regarded as the fundamental note of the chord. Rameau's views respecting the nature of this chord of the Diminished Seventh have, in the *Génération Harmonique*, undergone a radical change. In the *Traité* he explained it as a "borrowed" chord, an altered chord of the Dominant Seventh. Thus the chord $g\sharp-b-d-f$ he considered to be the first inversion of the chord $f-g\sharp-b-d$, where the note f is substituted for e , the real fundamental note of the chord. He now considers the chord $g\sharp-b-d-f$ to be derived from *two* fundamental sounds, namely, the Dominant and Subdominant. From the Dominant we obtain $g\sharp$ and b , and from the Subdominant d and f .² The first two sounds are the Third and Fifth of the Dominant harmony of A minor, $e-g\sharp-b$; while d and f are the fundamental note and third of the Subdominant harmony $d-f-a$, of the same key. Rameau is of opinion that the leading-note is the fundamental note of this chord, although he does not explain how the Fifth above this fundamental sound happens to be a diminished one. He states however

¹ *Gén. Harm.*, Ch. 14, Art. II.

² *Ibid.*

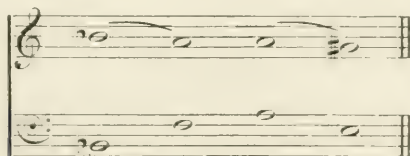
that "the leading note, although fundamental, owes this privilege to the Dominant, from which it is derived," that is, the Dominant is the real fundamental. This explanation he no doubt considered to be necessitated by the fact that the Dominant does not actually appear in the chord. The original form of the chord, then, being $g\sharp-b-d-f$, with the Dominant E as "root," we here find for the first time the chord of the Diminished Seventh stepping out to take up the rôle which it has played in so many text-books up to the present day, namely, as a chord of the *Ninth* with the fundamental note omitted. One of the principal advantages, according to Rameau, of regarding the chord in this aspect is that it is "now brought into conformity with other chords," that is, it now consists of a series of added Thirds.

The enharmonic change of which this chord is susceptible is made possible by temperament. If we change the chord $g\sharp-b-d-f$ into $a\flat-b-d-f$, the sounds of $g\sharp$ and $a\flat$ "appear, so far as keyed instruments are concerned, to be the same sound, but in the nature of the thing there is a difference of a quarter of a tone," of the proportion 125 : 128, which is the difference between the major and minor (diatonic and chromatic) semitones. By means of such an enharmonic change, two unrelated keys may be made to succeed one another: "this defect of relationship is replaced by the large number of sounds in common."¹ Rameau makes a passing reference to two other species of Enharmonic, namely, the *Diatonic Enharmonic*, and the *Chromatic Enharmonic*, without making any explanation as to their meaning or use. For their proper effect, he remarks, there are necessary what he has so far been unable to find, namely, tractable musicians, who are willing to entertain some sympathy, and exercise some patience with difficulties and novel effects to which they have never been accustomed. Rameau refers here to his experiences with the musicians of the Parisian Grand Opéra. Even thirteen years later he cannot refrain from again alluding to the subject. "I am not sure," he remarks, "whether this genus [the Chromatic-Enharmonic] suits the voice, but it can at least be realised on instruments, and this I attempted to effect in an earthquake in my Ballet of the *Indes Galantes*;

¹ *Gén. Harm.*, Ch. 14.

but here I was so badly served, and so badly received, that I found it necessary to substitute for it a more simple kind of music." ¹

But if these new kinds of Enharmonic are not explained in the *Génération Harmonique*, Rameau, on the other hand, treats of them at considerable length in his *Démonstration*. The *Diatonic Enharmonic* is explained as follows: "The alternate succession of a Fifth and a major Third, in which the triple progression is combined with the quintuple, gives a composite genus, called *Diatonic Enharmonic*; the semitones which are its products form a whole-tone step which is a quarter of a tone too large; thus these semitones, which are both diatonic, necessarily introduce the Enharmonic into the tone which they form, which makes its performance difficult for the voice but not impossible":— ²



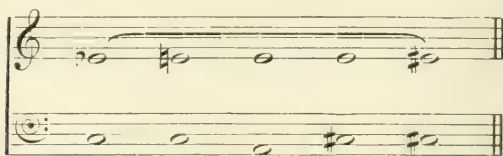
Here we find at $b\flat$ - a , a diatonic semitone, and another at a - $g\sharp$. ³ Adding these semitones together, we have an interval of the proportion $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$. Comparing this with the whole-tone of the proportion 9:10, thus $\frac{9}{10} \times \frac{1}{100}$, we obtain Rameau's quarter of a tone, that is $\frac{1}{100}$. This quarter-tone, compared with unity ($\frac{1}{100}$) gives us $\frac{1}{100}$, or nearly $\frac{1}{4}$. The interval $g\sharp$ - $b\flat$ is known to theorists as a diminished Third, that is, a minor Third diminished by a chromatic semitone: as $\frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$. If we compare this interval with that formed by adding two semitones together, we obtain $\frac{1}{44} \times \frac{2}{3} = \frac{1}{66}$. The two intervals therefore are not the same, but differ by a comma.

¹ *Démonst.*, p. 95.

² *Ibid.*, pp. 93, 94.

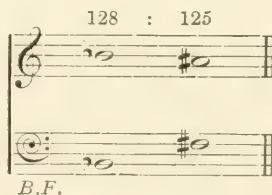
³ Here $B\flat$ in treble clef is $\frac{3}{4}$ of F, in the bass; while A is $\frac{2}{3}$ of F. Comparing these, we obtain $\frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$, that is, a diatonic semitone. Again A, in the bass, is $\frac{3}{4} \times \frac{2}{3}$ of $B\flat$ in the bass, and $= \frac{1}{2}$; while E is $\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$, and $G\sharp$ is $\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$, which, compared with A ($\frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$) is $\frac{3}{8} \times \frac{2}{3} = \frac{1}{4}$. A— $G\sharp$, therefore, is also a diatonic semitone.

As for what Rameau calls the *Chromatic Enharmonic* genus, the procedure is as follows: "If the bass descends a minor Third, and then rises a major Third, while the harmony above each sound of the fundamental bass is now major and now minor, there arises a composite genus called *Chromatic Enharmonic*, inasmuch as it gives rise to two minor semitones in succession which together form an interval a quarter of a tone less than a whole-tone":—¹



Here, the interval $b-c\sharp$, composed of two chromatic semitones ($\frac{2}{3}\frac{5}{4} \times \frac{3}{2}\frac{5}{4} = \frac{6}{5}\frac{2}{7}\frac{5}{8}$) is a quarter of a tone less than a minor tone ($\frac{6}{5}\frac{2}{7}\frac{5}{8} \times \frac{9}{10} = \frac{1}{12}\frac{2}{5}$).

Still another form of the *Chromatic Enharmonic*, but which is not so called by Rameau, is where the Fundamental Bass ascends by an interval equal to the sum of two major Thirds:—



"If one," he says, "passes from one to the other extreme of the quintuple proportion 1 : 5 : 25, there will result the quarter-tone 125 : 128, which is the difference between the major and the minor semitones."² "All these new genera," Rameau proceeds, "arise from the primary fundamental successions based on the triple and quintuple proportions, but the product of these successions has no power as regards

¹ *Démonst.*, pp. 94, 95.

² *Ibid.*, p. 91.

expression." Rameau means that the quarter-tone produced by the genera in question is practically indistinguishable, and is in itself too small an interval to impress the ear in any aesthetic sense. Again, "the further we move away from the primary fundamental successions, the further we move away from the Principal [Tonic centre], and as this Principal can be no longer understood in its product, such a product has no harmonic effect or expression; the Diatonic recalls the triple proportion, the Chromatic the quintuple proportion, and as already the latter is less simple than the triple, so the ear finds greater difficulty in understanding its product. As for the Enharmonic, it recalls nothing. It is the product of two extremes, extremely dissonant with each other, to which Nature herself has decreed that there should be no immediate succession; whence it is not astonishing that it cannot be appreciated by the ear."¹

Nevertheless, although Rameau thinks that the quarter-tone is too small an interval to be appreciated, or rather *understood* by the ear, he is of opinion that the *effect* of it may be experienced even on a tempered instrument, and that such effects are owing to the progression of the Fundamental Bass. "Besides that the quarter-tone is inappreciable, its expression, if this were possible" [for example a melodic series or succession of quarter-tones] "would bewilder the ear rather than assist it; thus it is banished from our keyed instruments; one never even thinks of expressing it on instruments without keys, where such could be effected by a gliding of the finger (as on the violin): the same key serves to express the two different sounds $125 - 128$ *la# - sib*, whence it is evident that if we experience the effect of the quarter-tone in such a case, this effect can only be caused by the *change of mode* [key] occasioned by the fundamental succession. . . . Is it, then, possible to doubt that the cause of such effects exists solely in the greater or lesser closeness of relationship between the modes of which the Fundamental Bass is the determining factor?"²

Rameau, therefore, quite definitely distinguishes three different species of fundamental bass:—(1) Fundamental Bass in fifths (1 : 3 : 5) : from this arises the *Diatonic System* ;

¹ *Démonst.*, pp. 95-97.

² *Ibid.*, pp. 101, 102.

(2) Fundamental Bass in Thirds ($1 : 5 : 25$): from this we obtain the *Chromatic System*; (3) The composite Fundamental Bass formed by combining these two: this gives rise to the *Enharmonic genus*. Rameau's Chromatic and Enharmonic genera it would be wrong to consider merely as harmonic curiosities; on the contrary they are, together with Rameau's treatment of them, of much importance for the theory of harmony. It will be noticed however that Rameau treats of only one kind of Chromatic semitone ($24 : 25$), and only one kind of quarter-tone ($125 : 125$). He says nothing of the Chromatic semitone which arises in the chromatic scale as the difference between the diatonic semitone and the major tone ($\frac{8}{3} \times 1\frac{6}{5} = 1\frac{3}{5}$), nor of the quarter-tones obtained by the harmonic division of the semitone ($\frac{3}{2}$ and $\frac{3}{2}$), nor that obtained by comparing the sum of two diatonic semitones with the major tone ($\frac{3}{2} \times \frac{3}{2} \times \frac{9}{8} = \frac{27}{16}$).

Further, how is Rameau to account for the fact that both the diatonic and the chromatic semitones, and the quarter-tone as well, were in actual use among the Greeks? He is scornful and entirely sceptical regarding the Greek quarter-tone. "What," he exclaims, "are we to think of the Ancients, who were acquainted only with the *products* of these different genera, when the effects which they attribute to them do not depend at all on these products, seeing that they—I refer to the quarter-tone—are inappreciable by the ear?"¹ Again Rameau himself, in treating of the chord of the Diminished Seventh, shows that the quarter-tone may arise, not as the result of a composite Fundamental Bass, nor of one which proceeds from one to the other extreme of the quintuple proportion, but from a Fundamental Bass which ascends a Third:—

(a) (b)

F.B.

¹ *Démonst.*, p. 101.

At (a) the chord of the Diminished Seventh undergoes an enharmonic change ($g\sharp-a\flat$) whereby there results the quarter-tone 125 : 128 ; the Fundamental Bass, according to Rameau, is $g\sharp-b$. If e and g be regarded as the fundamental sounds, we have still the minor Third progression of the bass. In the well-known enharmonic change ($g\flat-f\sharp$) in the Andante of Beethoven's C minor Symphony (b) the bass remains stationary.

Rameau points to several passages in his own works where, he says, the *effect* of this quarter-tone is produced, one of which is the opening Recitative, Act IV., of his opera *Dardanus*. The passage is evidently as follows :—

The musical score shows a vocal line and a piano accompaniment. The piano part consists of a series of chords: a G minor triad (G-B-D), followed by a diminished seventh chord (G-A-B-C), and then a B major triad (B-D-F#). The vocal line has a melodic line with some grace notes. The score ends with 'etc.'

Here Rameau either considers that in the first chord of the second bar $f\sharp$ undergoes an implied enharmonic change to $g\flat$;¹ or that the Fundamental Bass proceeds from d to $a\sharp$, from one to the other extreme of the quintuple proportion ; the chord $b\flat-d-f$ would then represent the enharmonic equivalent of the chord $a\sharp-c\sharp-e\sharp$. It is certain, however, that there is no enharmonic change here, whether expressed or implied, and it is equally certain that Rameau did not "*experience the effect*" of a quarter-tone, for there is none. All that happens is a somewhat abrupt but, since Rameau's day at least, quite common transition from the Dominant chord of a minor key to the Tonic chord of its relative major key : in this case, from G minor to B \flat major.

In his *Nouvelles suites de pièces de clavecin*, Rameau mentions two pieces—*L'Enharmonique* and *La Triomphante*, in which, he says, this quarter-tone occurs, and indeed

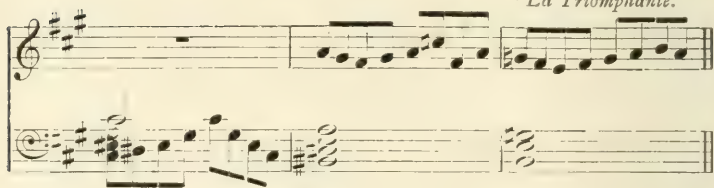
¹ See Riemann's (p. 402) and Prout's (p. 451) explanations of this chord.

gives a detailed explanation of the harmonic progressions. The passages he refers to are these :—

“ *L'Enharmonique.* ”



“ *La Triomphante.* ”



He remarks : “ The effect produced in the twelfth bar of *L'Enharmonique* will not perhaps please every one at first ; but custom will soon overcome repugnance [!] The harmony which produces this effect is not the result of chance or caprice, but is authorized by Nature itself. The same effect occurs in the fifth bar of the second *Reprise* of *La Triomphante*, but the effect here is less surprising, owing to the successive modulations. The effect arises from the difference of a quarter-tone found between the $c\sharp$ and $d\flat$ of the first piece, and between the $b\sharp$ and $c\natural$ of the second. . . . The impression we ought to receive does not arise, however, from the interval, but solely from the modulation.”

Here Rameau is of opinion that the “surprising effect” in the first passage is owing to the enharmonic change from $c\sharp$ to $d\flat$, whereby there arises a quarter-tone. But this is more than doubtful. The strange effect he speaks of has really nothing to do with the $d\flat$ of the second bar, but arises from the progression of the first chord to the second.¹ The progression from the second to the third

¹ Some theorists would no doubt explain this second chord as consisting entirely of “non-harmonic” passing-notes, and the chord itself as possessing no harmonic significance. But this is merely an easy and convenient means of getting rid of a difficulty. See, in connection with this subject, pp. 323 and 405.

chord, on the other hand, is quite regular. The essential harmony of the first chord is undoubtedly *a-c♯-c* ; it is impossible that *c♯* can represent *d♭* ; that of the second chord, according to Rameau himself, is *g-b♭-d*, and that of the third *c-e-g*. If we accept Rameau's statement that the chord of the diminished Seventh has a Dominant "*root*," these must represent the fundamental harmonies :—



Rameau, of course, does not here view the matter in this light, but considers that every note in each chord must form an essential constituent of the harmony. His point of view certainly demands consideration by the theorist, for even if Rameau is unable adequately to explain the generation of the chords of the Seventh and Ninth, nevertheless some explanation is necessary as to how and why the Seventh and Ninth should be permitted to intrude themselves into a harmony with which, apparently, they have nothing to do. The "*surprising effect*" which Rameau experiences in the passage in question is owing in part to the harmonic ambiguity of the chord of the Diminished Seventh, but chiefly to the immediate succession of two major harmonies unrelated to each other, and whose "*tonal functions*" are but vaguely determined. In addition the Fundamental Bass *descends* a whole-tone, a progression which, be it observed, is expressly forbidden by Rameau. But if there is no quarter-tone here, in the second example, on the other hand, the enharmonic change actually occurs. It is curious that Rameau should have regarded the first passage, in which there is no enharmonic change, as more strange in its effect than the second, where there really is such a change. He certainly describes quite accurately, however, the comparative effect on the ear of these two passages, but one finds a touch of delicious humour in the way in which Rameau dwells complacently on the charming and original effect produced by the first passage, an effect "*authorized by Nature*,"—but one which, nevertheless, he has himself expressly forbidden !

OTHER ASPECTS OF RAMEAU'S THEORY.

As for the other aspects of Rameau's theory in the works we are examining, these undergo little or no modification. Only as respects "Chords by Supposition" Rameau justifies his procedure in respect of these chords—Third or Fifth placed *below* the chord of the Seventh—by means of the arithmetical proportion. "Supposition has its source in one of the sounds of the arithmetical proportion added below the harmonic proportion: *suspension* is only a consequence of this." That Rameau has not yet a clear perception of the mechanism of suspension is evident from the examples he gives, where the chord at (a) is described as "a chord by supposition," while that at (b) is called a suspension, whereas both chords in reality contain suspended notes:—

(a)

(b)

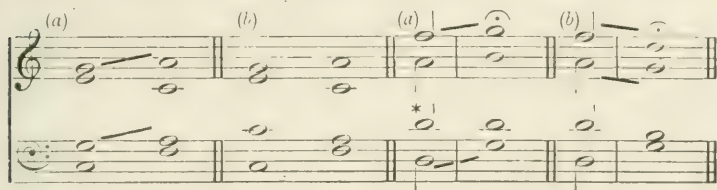
B.C. 9 6 5 etc.

B.F. 7 7 7 7

Prohibited consecutives—Octaves, Fifths—Rameau dismisses with the remark that these need give little trouble so long as proper attention is paid to the progression of the Fundamental Bass, and the connection between the harmonies. The origin of such prohibited consecutives is to be found in the immediate succession of the two Dominants. "Why are false relations [of the tritone], two Octaves, Fifths, and major Thirds in succession forbidden? You will find the reason . . . in the fundamental progression of the two Dominants" (*ut* — *re*).¹ "There is nothing in the nature of the Octave or the Fifth to displease us when the two are heard in succession; these consonances are in

¹ *Gén. Harm.*, Ch. 6.

themselves quite pleasing: the bad effect arises when they represent a fundamental succession without connection . . . If a good connection be preserved, one need not trouble much concerning the rest.”¹ This does not explain, however, why the consecutives at (a) should be displeasing in effect, while the same chord successions at (b) sound quite well. At * there is, besides, a better connection between the parts than in the example which immediately follows, in which there even occurs a hidden consecutive Fifth. Many similar cases constantly occur:—



For the practical use of the Fundamental Bass in composition the following directions are given: “There are three fundamental sounds, Tonic, Dominant, and Subdominant. We will call the Dominant—*Dominant-tonic*, every other Dominant simply *Dominant*.”

“Only the Tonic bears the perfect or natural chord: the Seventh is added to the Dominants, and the Sixth to the Subdominants.”

“There is only one Tonic in every key or mode: and only one Subdominant; every other note of the Fundamental Bass is a Dominant.”

“We may pass from one Tonic to another [that is, modulate] by every kind of consonant interval: Third, Fourth, Fifth or Sixth.”

“In addition, the Tonic may descend a Fifth to its Subdominant; ascend a Fifth or a Third to the Dominant-Tonic, or fall a Fifth, Third, or Seventh to a simple Dominant.” [That is, the Fundamental Bass may ascend or descend by any perfect, major or minor interval belonging to the key; the single exception being that of the bass *descending a Second*; such a step is prohibited.]

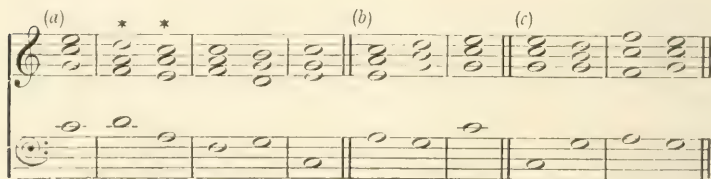
¹ *Gén. Harm.*, Ch. 19.

"The Tonic [harmony] alone is free in its progression: if it proceeds to another Tonic, this will possess the same privilege, otherwise it can only proceed to a Dominant, or a Subdominant, each of which has a determined progression."¹

In composition, then, in any mode, the method of procedure should be as follows: "Starting with the Tonic chord, you may proceed wherever you wish; whether to the Dominant, the Subdominant, to the Third below, or the Second above, and then give to these notes the succession which has already been determined for them: until finally the Tonic is reached."²

This abstract of rules for the progression of the Fundamental Bass does not differ, it will be observed, in any essential respect from the rules already given in the *Traité* and the *Nouveau Système*. What is most remarkable is that Rameau, who has accounted only for the three chief harmonies of the key, should think it unnecessary to explain whence he has derived the other harmonies, for example those on the Third and Sixth degrees of the scale; and that while the Fundamental Bass, which properly belongs to the diatonic key system, is a Fundamental Bass in *Fifths*, he nevertheless permits it, within a single key or mode, to ascend or descend by any other interval, the only exception being the descent of a Second. The whole question is one, as we shall see later, which causes Rameau much embarrassment.

It is, then, manifest that Rameau is unable to account for many of the simplest chord successions. In the following example (a) the chords at ** must be explained as Tonics, as any addition of a dissonance to their harmony would destroy their character, and the nature of the chord succession. This simple passage, therefore, would appear to be in three different keys. At (b) and (c) we find the forbidden descent of a Second in the Fundamental Bass. The effect, however, is good, indeed excellent:—



¹ *Gén. Harm.*, Ch. 18., Art. 1. (*De la Composition.*)

² *Ibid.*

CHAPTER IX.

OTHER THEORETICAL WORKS OF RAMEAU: *NOUVELLES
RÉFLEXIONS SUR LE PRINCIPE SONORE, ETC.*

Of other theoretical works of Rameau, less important than the *Génération Harmonique* and *Démonstration*, but nevertheless deserving of notice, there may be mentioned the following :—

(1.) *Dissertation sur les différentes méthodes d'accompagnement pour le clavecin ou pour l'orgue, avec le plan d'une nouvelle méthode établie sur une mécanique des doigts que fournit la succession fondamentale de l'harmonie, et à l'aide de laquelle on peut devenir savant compositeur et habile accompagnateur, même sans savoir lire la musique.* (Paris, 1732.)

(2.) *Code de musique pratique ou Méthodes pour apprendre la musique, même à des aveugles, pour former la voix et l'oreille, pour la position de la main avec une mécanique des doigts sur le clavecin et sur l'orgue, pour l'accompagnement sur tous les instruments qui en sont susceptibles, et pour le prélude, avec de nouvelles réflexions sur le principe sonore.* (Paris, 1760.)

(3.) *Nouvelles Réflexions sur la Démonstration du principe de l'harmonie, servant de base à tout l'art musical.* (Paris, 1752.)

(4.) *Réflexions de M. Rameau sur la manière de former la voix, d'apprendre la musique, et sur nos faculties pour les arts d'exercice.* (*Mercur de France*, Oct., 1752.)

(5.) *Extrait d'une réponse de M. Rameau à M. Euler sur l'identité des octaves, d'où résultent des vérités d'autant plus curieuses qu'elles n'ont pas encore été soupçonnées.* (Paris, 1753.)

(6.) *Observations sur notre instinct pour la musique et son principe.* (Paris, 1754.)

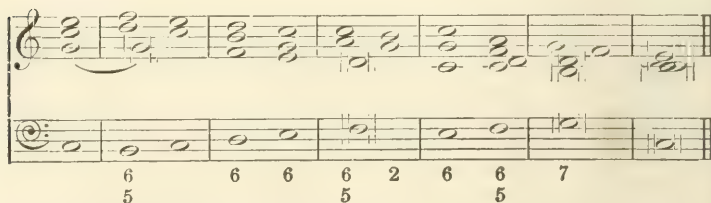
(7.) *Erreurs sur la musique dans l'Encyclopédie.* (Paris, 1755.)

(8.) *Suite des Erreurs sur la musique dans l'Encyclopédie.* (Paris, 1756.)

(9.) *Réponse de M. Rameau à MM. les Editeurs de l'Encyclopédie sur leur dernier avertissement.* (Paris, 1757.)

(10.) *Lettre aux philosophes, concernant le corps sonore et la sympathie des tons.* (Paris, 1762.)

In the work first mentioned Rameau applies the theoretical principles which he has developed in his *Traité* towards the simplification of the method of accompaniment. "The chief difficulties in accompaniment," he remarks, "have always been : (1) The method of fingering employed ; (2) *the rules, and the methods that have so far been given to us* !" Rameau's "method," in which the rules are few and simple, is distinguished by a reduction of the numerous possible harmonic combinations to a few simple primary harmonies, by the use of harmonic inversion, and of the Fundamental Bass. He directs that "the bass be played with the left hand, while the harmony proper to it is executed with the right." If all notes common to two successive chords be retained in the fingering, and in all other cases, movement by step be preferred to that by leap, the fingering will give very little trouble. For example :—

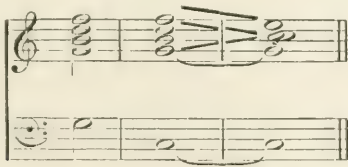


This is far enough removed from the contemporary Italian school of figured-bass playing, the dominant characteristic of which was the breaking up of the harmony by means of graceful contrapuntal figuration (Scarlatti, Durante, Porpora, etc.), but beyond all question it represents the best possible method of obtaining a strictly logical and connected series of chord successions, and it is surprising that such a method of figured bass should not have been adopted in more elementary text-books of harmony.

Code de Musique pratique.

This work, which is much larger than the *Dissertation*, treats not only of accompaniment at the clavecin and organ, but comprises also a school of composition, as well as a "method" for forming the voice and ear; here also Rameau indulges in some interesting reflections on the purely æsthetic and expressive side of his art.

Although Rameau still adheres to his theory of "chords by supposition," he is now much more disposed than formerly to consider these chords as resulting from the mechanism of *Suspension*. This is noteworthy. Thus the "chords by supposition" of the Ninth and the Eleventh are explained as being formed from the suspension of the Octave by the Ninth (9-8), and of the Third by the Fourth (4:3).¹ Not only so: the chord of the Tonic may be suspended—retarded—by *all* the notes of the chord of the Dominant Seventh, and in the Minor Mode by the chord of the Added Sixth. "The Fifth may not only be suspended by the Sixth, but the Third may be suspended by the Fourth and the Second [Ninth]; that is to say, *the Tonic chord may be suspended by the complete chord which precedes it*: whether this be the chord of the Dominant Seventh, or, in the Minor, the chord of the Added Sixth." It should be noted that the chapter in which Rameau makes this statement is entitled *Notes d'ornement ou de goût*.² So then, in the following passage, Rameau no longer considers the chord *g-b-d-f* in the second bar to represent the really essential harmony, for it merely serves to retard the notes of the Tonic chord:—



There can be little doubt but that Rameau's theory, in respect of these chords, undergoes a change for the better; but he does not observe that he completely demolishes his

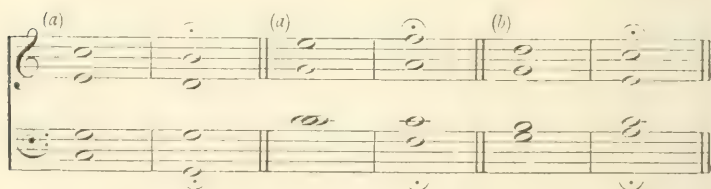
¹ *Code de Musique*, XXI^e Leçon: "Des suppositions et des suspensions."

² *Ibid*, Ch. 12.

own theory of Supposition, whereby the really essential chord ought to be regarded as that of the Dominant Seventh, the note C being added below, as a "supernumerary sound."

With regard to dissonant chords, not only does the chord of the Dominant Seventh require no preparation, but also "none of the dissonances of which the leading note forms a part [Dominant discords!] require to be prepared."¹ As for the chord of the Added Sixth, the Sixth does not require preparation; "the Fifth, on the contrary, must always be prepared." Rameau does not explain how it comes about that the Sixth, the *dissonant* note of this chord, requires no preparation, while the Fifth, which is consonant, must be prepared.

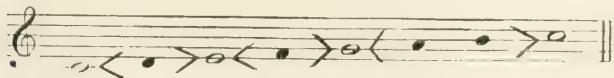
Once more Rameau touches on the vexed question as to which degrees of the scale may bear a consonant harmony. In the *Traité* he is, at first, in no doubt whatever that the only consonant chord in a key is the Tonic chord. Every other chord is dissonant, and whether the dissonance be actually present in the chord or not, it must nevertheless be understood as forming an essential part of the chord. Thus the Dominant chord *g-b-d* always represents the chord of the Dominant Seventh *g-b-d-f*, and the Subdominant chord *f-a-c*, the chord of the Added Sixth *f-a-c-d*. For this reason the Dominant and Subdominant chords have a strong tendency towards the Tonic chord, and their resolution on this chord serves to heighten that effect of repose which properly belongs to it only. But in treating of the Dominant and Subdominant *Cadences* Rameau finds himself obliged to modify this statement, for now the Dominant and Subdominant chords are themselves chords of repose (*a*), and this must necessarily be the case if they are to produce a proper cadential effect. So with other chords (*b*):—



¹ *Code de Musique*, Ch. 7, Art. 17.

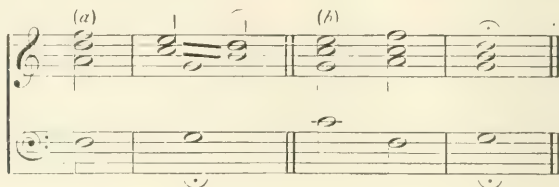
These chords must be regarded as in themselves consonant, for any dissonance added to their harmony would destroy their character as chords of repose. For the moment, therefore, Rameau concedes that a consonant harmony may appear on the Dominant and Subdominant, as well as on the Tonic. Nevertheless, we find him very soon afterwards repeating his former statement that the only consonant chord is that of the Tonic, and that wherever such a harmony is found, it must be regarded as a Tonic harmony. Rameau is here confronted by a very real difficulty. If the Dominant, or any other chord, has a decided tendency towards the Tonic harmony, then such a chord is one inducing motion, unrest; how then can such a chord produce an effect of repose? Must it not be regarded as no longer Dominant, but Tonic, and bringing about a change of key? The problem is one which evidently completely baffles Rameau.

Let it be observed that Rameau, in insisting as he does in all his most important theoretical works that the only consonant harmony in the key is that of the Tonic, is enunciating a real principle of Tonality. Seeing that he has this principle already within his grasp, why, it may be asked, did he not make greater use of it? He might have demonstrated that the notes of the Tonic chord are the only notes of rest in the scale, and that the other notes are notes of unrest, each of which tends strongly to proceed to that note of rest which lies nearest to it. Thus in the scale of C major, the notes of rest are *c-e-g-c'*:—

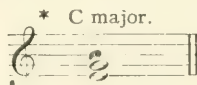


and the notes of unrest *d-f-a-b*. Of these latter, the notes *f* and *b*, which are respectively distant only a semitone from the notes *e* and *c*, are the notes of greatest unrest. But Rameau quite rightly avoids such a course. For if the note *b*, the leading note, is the note of greatest unrest in the whole scale, how then can it be a note of rest, as it actually is in the Dominant

Cadence? At (a) the note *b*, the note of greatest unrest, appears as a note of rest: while the Tonic *c*, the note of greatest rest in the scale, and its Third *e*, appear as notes of unrest:—



Again, if the fourth degree of the scale is a note of great unrest, how can its harmony produce an effect of repose, as in the Tonic-Subdominant Cadence? If it be considered that the effect of repose which may be produced by the Dominant harmony is owing to the fact that the Dominant itself is a note of the Tonic chord, and therefore a note of rest, then the presence of *two* notes of the Tonic harmony in a chord ought to increase still further the effect of repose*:—



This, however, is by no means the case. It would seem, therefore, that the notes of rest in the scale, quite apart from the question of dissonance and its resolution, may appear as notes of unrest, and the notes of unrest as notes of rest, according to circumstances. Not only so; it results from the Tonic, Dominant, and Subdominant Cadences that *all* the notes of the scale may be regarded as notes of rest. Rameau no doubt perceived that he was unable to derive much help from this source. Nor did it enable him to account for the tendency of the Subdominant or the Supertonic triad towards the harmony of the Dominant (b).

In the *Code de Musique* Rameau emphasizes what he had already demonstrated in the *Traité*, that from the Perfect Cadence are derived all the rules of harmonic progression. All harmonic music is but a series of Cadences. "The Perfect Cadence is the origin of the diversity which characterizes

harmony. One inverts this Cadence, interrupts it, imitates it, avoids it, and by such means variety in harmony is brought about." ¹ In this, which is almost his last important work on the subject of harmony, Rameau makes no further attempt to account for the triads on the second, third, and sixth degrees of the scale.

Nouvelles Réflexions sur la Démonstration du principe de l'harmonie, etc.

Neither in the *Démonstration* nor in the *Nouvelles Réflexions* does Rameau devote much space to his theory of "double employment." In the latter work we find merely a passing reference to the subject. "If the Greeks," he remarks, "were ignorant of the origin of their diatonic tetrachord, they were at least well inspired, for this tetrachord composed of the sounds *si-ut-ré-mi* gives, in the diatonic order, both the Perfect Cadence and the limits of the mode of which *ut* is the generator; whereas in adding *fa* and *la*, these sounds may be regarded as belonging to either the Dominant or the Subdominant keys! (*en lieu qu'en y ajoutant fa et la, les Modes de la dominante & de la sous-dominante pourroient toujours le disputer à celui de leur générateur*). If *la* is employed as fifth of *ré*, it must be regarded as being in the key of the Dominant; . . . if, on the other hand, it is employed as third of *fa*, then the Subdominant will be arbitrary"—(that is, will have no tendency towards the Tonic chord). "This two-fold origin of the sound *la*, where, in the same key, it may appear as fifth of *ré*, or third of *fa*, is the cause of double-employment." ²

If Rameau is unable to show how the scale is derived from three fundamental sounds, but considers it to be necessary to add a fourth for this purpose, the addition of the fourth fundamental sound has at least, he states, this merit, that by this means we obtain the fourth proportional necessary for the "rule of three" in geometry. In his later writings he is preoccupied with the idea that a close relationship exists between musical proportions and other arts and sciences, especially Architecture. He has been confirmed in his views on this subject by "M. Briseux, the architect, who intends

¹ *Code de Musique*, Ch. 7, Art. 15.

² *Nouvelles Réflexions sur la Démonstration, etc.*, pp. 26, 27.

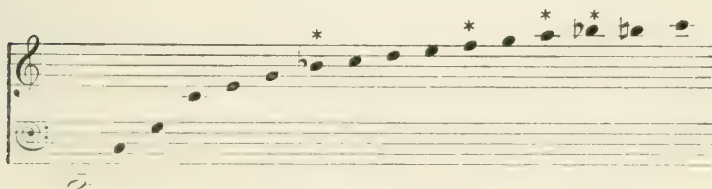
shortly to publish a treatise, in which he is to demonstrate, among other things, that the beautiful edifices of the ancient Greeks and Romans . . . were constructed according to the proportions derived from Music. This justifies the view which I have long held, that in Music there is unquestionably to be found the principle of all the arts of taste, . . . it is from the regular division of the string in its several parts that arise the proportions, each in its order of pre-eminence, or of subordination . . . wherein it is to be remarked that division precedes multiplication, a fact which ought to guide one with greater certainty than has hitherto been possible towards establishing the basis of a most noble and sublime philosophy.”¹

We find also a reference to Sir Isaac Newton and his “scale of colours.” “If M. Newton had been acquainted with this principle, would he have selected a diatonic system, a system simply of products, one which is full of error, in order to compare it to colours? Would he not, first of all, have inquired whether each of these colours ought not to be considered as forming a bass, a generator, whereby the colours form themselves into pleasing groups? . . . Let us not be deceived: the Arts, known as Arts of taste, are less arbitrary than their title would seem to imply. It is impossible at the present day not to recognize that they are based on principles, principles so much the more certain and immutable inasmuch as they are given by Nature; principles the knowledge of which enlightens talent and regulates the imagination, and ignorance of which is a source of the absurdities of men of mediocre talent, and the blunders of men of genius.”²

Although Rameau seems here to reprove Sir Isaac Newton for having failed to perceive what was the true foundation of a theory of colours, namely, the principle of harmony, nevertheless, in the analogy he draws between the physical properties of sound and light he is by no means talking at random. A close analogy exists, closer indeed than the scientists of Rameau’s time were able to suspect. (Light—a vibration of the ether; sound—a vibration of the air; wave-theory of light, as well as of sound.) Of especial significance for Rameau must have been the fact that the various colours of the rainbow existed in white light, just as partial tones existed in the compound musical sound.

¹ *Nouvelles Réflexions sur la Démonstration, etc.*, pp. 49-51. ² *Ibid.*

Rameau subsequently enters into an investigation concerning the natural sounds of the horn and trumpet. He finds himself unable to show how it is that we receive the major scale—of the minor scale he takes no notice—directly from Nature. On the contrary, he demonstrates that of all the sixteen *natural* sounds produced by the horn or other instruments, the only sounds of the scale we are able to accept are those which together make up the harmonies of the Tonic and Dominant. The other sounds are *false*! notwithstanding that they are given by Nature. Thus if C be the fundamental sound, the Tonic, we are able to select certain sounds from the first sixteen natural sounds, so as to form the following scale *c-d-e-g—b-c'*:—



All these sounds are in tune: the sounds *f* and *a* are certainly also to be found, but they are so much out of tune that it is impossible to include them in the above scale.¹

All that Rameau deduces from this circumstance is that “as Nature has given us *at first* only those sounds of the Mode” which correspond to the harmonies of “the generator and its Dominant,” therefore the succession of harmonies, Dominant-Tonic, is more natural than that of Subdominant-Tonic. This is confirmed by the fact that inexperienced persons find it much easier to sing the fundamental bass *ut-sol* or *sol-ut*, than *ut-fa*, or *fa-ut*; also by the fact that the timpani of the orchestra are tuned to the Tonic and Dominant of the key.²

¹ *Nouvelles Réflexions sur la Démonstration, etc.*, pp. 78-81.

² *Ibid.*, pp. 77-80.

Nouvelles Réflexions sur le Principe sonore.

The *Nouvelles Réflexions sur le Principe sonore*, appended to the *Code de Musique pratique*, is in reality an independent treatise, and of considerable theoretical importance. This treatise furnishes fresh proof that the ideas of Rameau on the subject of harmony were in a state of constant flux, and his theories in a never-ceasing process of development, even up to the end of his life. In the physical properties of the sonorous body Rameau now sees not only the principle of harmony, as well as of other arts ; it is a universal principle, the principle of the cosmos itself. He remarks : " There is one principle underlying all things ; this is a truth which has presented itself to the minds of all thinkers, but the more intimate knowledge of which has been attained by no one. Convinced of the necessity of this universal principle, the earliest philosophers sought for it in Music. *Pythagoras*, following the Egyptians, saw the laws of harmony in the movements of the planets ; *Plato* made it the governing principle of the soul ; *Aristotle*, his disciple, after saying that Music is a thing celestial and divine, adds that one finds in it the explanation (*raison*) of the world-system. In short, impressed by the agreement, the wonderful harmony to be observed in their relationship to each other of the different parts which compose the Universe, these thinkers considered that the explanation of such a harmonious relationship must necessarily be found in Music, in which alone proportions exist : that is, in the case of every other sense but that of hearing, these do not present themselves directly, but only in a symbolic aspect (*elles n'en sont, à proprement parler, que l'image*). But unfortunately the system which these great men adopted, far from bringing them nearer the object of their researches, only served to remove them further from it. I venture even to assert that the phenomenon of the sonorous body was absolutely unknown to them." ¹

Rameau subsequently develops his ideas on this subject in the section entitled "*Conséquences des Réflexions précédentes pour l'origine des Sciences*," in which he gives a hypothetical account of the musical impressions likely to have been

¹ *Nouvelles Réflexions sur le Principe sonore*, Introduction.

received by the first man, Adam, when he found himself placed in a world which was unfamiliar to him. Adam, he thinks, could hardly fail to observe that musical sound was not simple, but compound; after the discovery of this fact, it was but a step to the recognition of the identity of Octaves, and the discovery of the triple geometrical progression (1:3:9). From the triple progression would arise the diatonic tetrachord. These achievements of Adam were undoubtedly familiar to Jubal, "*ipse fuit pater canentium cithara et organo.*" At the time of the Deluge, Noah must have been able to save amongst his other effects the instruments of Jubal, the tetrachord, and the triple progression. During the building of the tower of Babel, and the subsequent dispersal of the peoples, it would seem to be highly probable that the triple progression was appropriated by the Chinese, while the tetrachord found its way into Egypt, where Pythagoras gained his knowledge of it. To the Chinese, on the other hand, the tetrachord was unknown, but from the triple progression they formed the pentatonic scale, which naturally arises from a fundamental bass in Fifths, thus:

$$\begin{array}{c} \text{sol—la—ut—re'—mi} \\ \text{F.B. ut—fa—ut—sol—ut} \\ 3—1—3—9—3 \end{array}$$

In all this, which sounds so highly improbable to us, the time in which Rameau wrote must be taken into account.

More important for our purpose is the *new theory of the "natural mode"* now proposed by Rameau. This "natural mode" (major scale) he now explains as arising from the natural sounds of the harmonic series extended to the 45th term. By a process of selection we obtain from this series all the sounds necessary for the formation of the major scale. Rameau has already pointed out that the fundamental sound being regarded as Tonic, the only sounds which are "in tune" of all the first 16 harmonics of the horn or trumpet, are those which correspond to the harmonics of the fundamental sound and of its fifth. That is, Nature presents us in these harmonic sounds with the harmonies of the Tonic and Dominant only: *the Subdominant can never be discovered among these harmonies*, not even if they are extended to infinity. Rameau gets over this difficulty by a means which, if it is not convincing, at least extorts admiration because of its ingenuity. He makes the third harmonic

sound, instead of the first, the determining note of the mode, or Tonic. Thus, if C be the fundamental sound, we obtain from the first 16 harmonic sounds the harmonies *c-e-g* and *g-b-d*; if now we consider this second harmony to represent the Tonic harmony, *the first harmony will represent that of the Subdominant*. In proceeding thus we are deprived, it is true, of the Dominant harmony, but this may be discovered by a further extension of the harmonic series: the Dominant harmony *d-f#-a*, will then be represented by the numbers 9 : 27 : 45.

We are now in possession of the three harmonies necessary for the formation of the key-system:—

$$\begin{array}{c} \text{C} \text{---} \text{e} \text{---} \text{G} \text{---} \text{b} \text{---} \text{D} \text{---} \text{f}\sharp \text{---} \text{a} \\ \text{1} \qquad \qquad \text{3} \qquad \qquad \text{9} \end{array}$$

in which the central harmony, represented by the central term (3) must be regarded as the determining, that is, the Tonic harmony: that of the Subdominant (1) is its *antecedent*, while that of the Dominant (9) is its *consequent*. It is true that the sounds $\frac{a}{27}$ and $\frac{f\sharp}{45}$ cannot be produced on the instruments in question; “but this is not the fault of Nature, nor that of the instrument; it is owing rather to our limited faculties that we cannot produce on these instruments the sounds of the $\frac{1}{27}$ and $\frac{1}{45}$.”

As for the minor harmony, this is found *among the first 16 sounds of the harmonic series*; thus:— $\frac{e}{10} \text{---} \frac{g}{12} \text{---} \frac{b}{15}$.¹

Rameau proceeds in thorough fashion to develop all this, and apply it to the explanation of the Major and Minor Modes, and of their relationship. He has first to explain whence he derives the liberty of making the Fifth (G) of the fundamental sound (C) the determining note, or Tonic; for in his previous works—even if, in his fundamental bass of three terms 1 : 3 : 9, he has consistently assigned to 3, the Dominant, the function of central term, or Tonic—he has given cogent reasons why this privilege should be accorded to the fundamental sound itself: this sound represents Unity, by which all the other sounds are determined. The explanation is as follows: The sonorous body, in vibrating,

¹ *Nouvelles Réflexions sur le Principe sonore*, pp. 198-201.

causes to be heard distinctly among its harmonic sounds only those of the 12th and 17th. The Octave and 15th also form a part of the resonance of the sonorous body, but the ear cannot appreciate them with the same facility: "it is only with the greatest attention that they can be distinguished." "They blend together in such a manner with their generator, that they become one with it; they become, in consequence, the Principal itself."¹ In the geometrical progression $1 : \frac{1}{2} : \frac{1}{4}$, the middle term $\frac{1}{2}$, then, represents the Principal 1, and is indeed this Principal itself. Extraordinary as it may seem, Rameau considers this to be a sufficient reason for making the middle term of the geometrical progression $1 : 3 : 9$ ($1 : \frac{1}{3} : \frac{1}{9}$) the determining sound or Tonic (*ordonnateur*) of the mode. "In short," he remarks, "the Principal, the generator, in producing Octaves in either direction [$1 : \frac{1}{2} : \frac{1}{4}$ or $1 : 2 : 4$], from which arises for the first time a geometrical proportion, gives us, at the same time, by means of 3 and 5, other geometrical proportions, namely, $1 : 3 : 9$, and $1 : 5 : 25$, in which the middle term, 3 or 5, predominates, in the same way as the term 2 of the first geometrical progression $1 : 2 : 4$." Thus we obtain the major system

C - G - D
1 : 3 : 9

As for the *Minor Mode*, and its relationship with the major mode, Rameau proceeds thus:—"While the sound $\frac{1}{3}$ [G] is that which determines all harmonic and melodic succession, we must not leave out of account the sound $\frac{1}{5}$ [E]: if $\frac{1}{3}$ is the cause of what is most perfect in such a succession, $\frac{1}{5}$ adds variety to it. Further, this $\frac{1}{3}$ selects $\frac{1}{5}$ as the determining sound of its Mode [the Minor Mode], and not only prescribes its progression, but also its harmony. For

12 : 15 : 18
g — b — d

example, if *sol* [G], of which the harmony is *sol—si—re'* determines the Major Mode, it is *mi* [E] which deter-

10 : 12 : 15
e — g — b

mines the Minor Mode with this harmony *mi—sol—si* where we find that *mi* is subordinated to *sol*, which however is the sole cause of the difference between the two

¹ *Nouvelles Réflexions sur le Principe sonore*, pp. 194-195.

modes, a difference which consists in the quality of the *Third*. At the same time this *sol* gives its *Third* $\overset{15}{si}$ to the sound *mi*, in order to constitute its harmony, by the formation of the Fifth $\overset{5}{mi} : \overset{15}{si}$. The same subordination is further to be observed between the extremes of each proportion, that is to say, that the antecedent of the Major Mode [that is *c-e-g*] lends its Octave and Third to that of the Minor Mode [that is *a-c-e*]; the same is true of the consequent [*d-f#-a*], only the consequent of the Minor Mode ought to have a major harmony whenever it precedes its middle term."¹ These remarks should be compared with the passages already quoted from the "*Démonstration*,"² in which this theory of the formation of the Minor Mode appears for the first time.

Thus Rameau, in what is practically his last pronouncement on the subject of harmony, brings forward a theory of the generation of the Major Mode which, in its most essential features, differs from that of his previous works. It is a new theory, in which all the sounds of the major scale are derived from the sounds of the harmonic series. While Rameau, in his *Génération Harmonique*, finds it necessary,

¹ "En cédant à son $\frac{1}{2}$ la direction de toute la marche harmonique & mélodieuse, ne croyons pas que le principe ait oublié son $\frac{1}{2}$: & si le $\frac{1}{2}$ produit ce qu'il y a de plus parfait dans cette marche, non seulement le $\frac{1}{2}$ y ajoute des variétés qui l'embellissent, mais ce $\frac{1}{2}$ le choisit encore pour ordonner de son Mode renversé, en le revêtissant de tous ses droits, jusqu'à lui prescrire sa proportion triple, & à former son harmonie de la sienne propre. Si *sol*, par exemple, dont l'harmonie est $\{ 12 : 15 : 18 \}$ ordonne du Mode majeur, c'est pour lors *mi* qui ordonne

du mineur avec cette harmonie $\left[\begin{array}{ccc} 10 & 12 & 15 \\ mi & sol & si \end{array} \right]$ où $\overset{5}{mi}$ se subroge aux droits de son législateur, qui néanmoins s'y conserve celui d'être la seule cause de la différence des effets qu'on éprouve entre les deux Modes : différence qui consiste dans le genre de la tierce, dont il occupe pour lors la place, outre qu'il livre encore sa tierce $\overset{15}{si}$ à ce même *mi*,

pour constituer son harmonie, en formant sa quinte $\overset{5}{mi} - \overset{15}{si}$

"La même subrogation s'observe, de plus, entre les extrêmes de chaque proportion, c'est-à-dire que l'antécédent de Mode majeure prête son octave & sa tierce à celui du Mode mineur." (*Nouvelles Réflexions sur le Principe sonore.*)

² *Ibid.*, pp. 257-264.

in utilizing the harmonic sounds for the purposes of his theory, to call a halt at the number 6, he now presses into his service harmonic sounds such as the $\frac{2}{7}$ and $\frac{4}{5}$. That Rameau should at the end of his life subject his theory to such a new and strange development seems at first sight to be a remarkable circumstance. Seeing that, when he published the work we are now examining, the master was 77 years of age, and presumably therefore no longer enjoying the full exercise of his powers, the thought suggests itself that it is rather to the *Génération Harmonique* and the *Démonstration* that we must look for his mature and fully-developed theory of harmony. But there are several circumstances connected with this last development of Rameau's theory which militate against the view that age had dimmed his insight or impaired his intellectual vigour. He had discovered that he had made a serious error with regard to the nature of the acoustical phenomenon which he had considered to constitute the physical basis of the minor harmony. The principal sound had not, as he had imagined in his *Génération Harmonique*, the power to excite co-vibration in its multiples of the 12th and 17th major, but only in those portions of the string which corresponded to the Unison of the exciting sound. It is quite evident that this discovery had caused Rameau serious misgiving. The minor harmony was left without a physical basis. And not the minor harmony only, but the Sub-dominant as well.¹ Rameau then turns afresh to the harmonic series, with the increasing conviction that in it alone is to be found the explanation of the secrets of harmony.

Hence the new theory as to the origin of the Minor Mode which he proposes in the latter part of the *Démonstration*. He there remarks: "What does Nature indicate? She indicates that the principle [harmonic resonance] which she has once for all established shall, and ought to, dominate everywhere; that everything ought to be related to it, subordinated to it—harmony, melody, mode."

It is not surprising, then, to find that in the work we are now examining, Rameau not only restates his views which he had already advanced in the latter part of the *Démonstration* as to the origin of the Minor Mode, but demonstrates

¹ See pp. 231-237.

that the minor harmony itself $10 : 12 : 15$ arises from
 $mi - sol - si$
 the sounds of the harmonic series. Here *sol*, the Tonic of the major system, has as its major Third the sound *si*, but this sound is also Fifth of *mi*; *sol* then appears as minor Third of the minor harmony. That the minor harmony should be found among the sounds of the harmonic series in just such a position as this, is evidently for Rameau a remarkable proof of the correctness of his new theory of the origin of the minor mode.¹ Further, not only the minor harmony arises from the sounds of the harmonic series, but, indeed, *all the sounds necessary for the formation of the Minor Mode*.¹ At the same time, it must be pointed out that in the minor we have again the proportions of the major harmony, but in inverted order. In this sense, the minor harmony is an inverted major harmony. Such an inversion, however, is contrary to the natural order.²

But notwithstanding this reference to the arithmetical proportion, Rameau's views as to the origin of the minor harmony and the Minor Mode are in no wise different from those which he had advanced in the latter part of his *Démonstration*. It is not in the co-vibration of the multiples that we discover the proper physical basis of the minor harmony. This phenomenon merely indicates the *possibility of the formation of such a harmony*. How this harmony is actually formed, Rameau has already explained. Quite as remarkable as Rameau's discovery of the minor harmony and the minor mode among the sounds of the harmonic series, is his discovery

¹ " Dans ces mêmes instruments, l'accord de la proportion arithmétique, renversée de l'harmonique, s'entend entre les sons $10 : 12 : 15$
 $mi - sol - si$
 où les octaves du $\frac{1}{2}$ & du $\frac{1}{3}$ sont à 10 & à 12, où ce $\frac{1}{3}$ forme le tierce mineure du $\frac{1}{2}$, & où $\frac{1}{15}$, tierce de ce $\frac{1}{3}$, constitue l'harmonie du $\frac{1}{2}$, dont il est quinte. Ainsi l'oreille & la raison y concourent également pour nous convaincre, et sur le renversement entre ces deux proportions, d'où suit celle du Mode majeur en mineur, et sur l'agréable effet que nous en éprouvons. Tout l'ordre diatonique du mineur s'entendrait mêmes dans les aliquotes des corps sonore en question, si l'on avoit la faculté d'en pouvoir tirer les sons." (*Nouvelles Réflexions sur le Principe sonore*, p. 203.)

² " La proportion harmonique, formée des sous-multiples $1 : \frac{1}{2} : \frac{1}{3}$, se dénature totalement dans les multiples $1 : 3 : 5$, car elle se renverse pour lors en proportion arithmétique d'où résulte le changement," etc.—*Ibid.*, p. 195.

of the Subdominant in this same series. In his *Nouvelles Réflexions sur la Démonstration*, etc., Rameau had discovered that of the three fundamental harmonies which together constituted the major key-system those of the Tonic and Dominant existed among the first 16 sounds of the harmonic series. Not only the major harmony, then, existed in Nature, but part of the major key-system itself, and this the most important part. Further, Nature herself indicated the relationship between these two fundamental harmonies: for the third harmonic sound was not only Fifth of the fundamental sound, but was itself a fundamental, giving rise to its own series of harmonic sounds. But with regard to the Subdominant harmony, Rameau was, of course, quite unable to find for it a similar explanation. He therefore concluded that "as Nature has given us at first only those sounds of the Mode which correspond to the harmonies of

Tonic. Dominant.

the generator and its Dominant" as $\underbrace{c - e - g}_{1 \quad 3} - \underbrace{b - d}_{3 \quad 1}$

therefore the succession of harmonies Dominant-Tonic is more natural than that of Subdominant-Tonic.

But now Rameau, by the adroit addition of a third term not downwards, but *upwards*, finds himself able, as he imagines, to derive all the sounds necessary for the major key system from the harmonic series, thus Sub-dom. Tonic. Dom.

$\underbrace{c - e - g}_{1 \quad 3} - \underbrace{b - d - f\sharp - a}_{3 \quad 9}$. Nevertheless, he is not much

further forward. He is totally unable to explain how *c*, the Tonic, has acquired the character of Subdominant, and the Dominant *g*, that of Tonic. The Tonic *g*, then, is no longer the fundamental sound, the "Principal"; this privilege is accorded to the Subdominant: and the sound in which, as Rameau has assured us, harmony, the Modes, chord-succession, modulation, etc., have their origin, is not the Tonic, but the Subdominant. And yet there is little doubt but that Rameau still understands the Tonic as the "fundamental sound," which represents Unity, and "in which all the other sounds have their origin."

It is not surprising to find that Rameau's ideas on the subject of the *origin of dissonance*, or of dissonant chords,

also undergo a remarkable development. Here we find nothing less than the *Hauptmann theory of the formation of chords of the Seventh*, by means of the conjunction of triads closely related to each other by notes which they possess in common! Rameau's method of effecting this conjunction is certainly an extraordinary one. If, he says, we add a

fourth proportional to this major triad $\begin{smallmatrix} 12 : 15 : 18 \\ g - b - d \end{smallmatrix}$ as well

as to this minor one $\begin{smallmatrix} 10 : 12 : 15 \\ e - g - b \end{smallmatrix}$, that is, before the antecedent of the one, and after the consequent of the other, so that

they are conjoined, we shall have $\begin{smallmatrix} 10 : 12 : 15 : 18 \\ e - g - b - d \end{smallmatrix}$. In a similar

way, if we combine $\begin{smallmatrix} 8 : 10 : 12 \\ c - e - g \end{smallmatrix}$ with $\begin{smallmatrix} 10 : 12 : 15 \\ e - g - b \end{smallmatrix}$ we obtain

the chord of the Seventh $\begin{smallmatrix} 8 : 10 : 12 : 15 \\ c - e - g - b \end{smallmatrix}$. From the first chord

of the Seventh there arises the interval $\begin{smallmatrix} 10 : 18 \\ e - d \end{smallmatrix}$, which, by

inversion, gives us the minor tone $\begin{smallmatrix} 9 : 10 \\ d - e \end{smallmatrix}$; and from the second

chord of the Seventh, the interval $\begin{smallmatrix} 8 : 15 \\ c - b \end{smallmatrix}$, the inversion of

which is the major semitone $\begin{smallmatrix} 15 : 16 \\ b - c \end{smallmatrix}$.

¹ Soit effectivement ajoutée une quatrième proportionnelle géométrique à cette proportion harmonique $\begin{smallmatrix} sol - si - re \\ 12 : 15 : 18 \end{smallmatrix}$, en même-temps qu'à cette

arithmétique $\begin{smallmatrix} mi - sol - si \\ 10 : 12 : 15 \end{smallmatrix}$, c'est-à-dire, avant l'antécédant de l'une &

après le conséquent de l'autre, où elles se confondent pour lors,

nous aurons $\begin{smallmatrix} mi - sol - si - re \\ 10 : 12 : 15 : 18 \end{smallmatrix}$, qui donnent une septième de $\begin{smallmatrix} mi \\ 10 \end{smallmatrix}$ à $\begin{smallmatrix} re \\ 18 \end{smallmatrix}$,

dont le ton mineur $\begin{smallmatrix} re - mi \\ 9 : 10 \end{smallmatrix}$ est renversé. Assemblons cette même

proportion arithmétique avec cette autre harmonique $\begin{smallmatrix} ut : mi : sol \\ 8 - 10 - 12 \end{smallmatrix}$, une

pareille proportionnelle, dans un ordre opposé au précédent, où les deux

proportions se confondront également, fournira dans $\begin{smallmatrix} ut : mi : sol : si \\ 8 - 10 - 12 - 15 \end{smallmatrix}$

une nouvelle septième de $\begin{smallmatrix} ut \\ 8 \end{smallmatrix}$ à $\begin{smallmatrix} si \\ 15 \end{smallmatrix}$ dont le demi-ton majeur $\begin{smallmatrix} si - ut \\ 15 : 16 \end{smallmatrix}$

est renversé. (*Nouvelles Réflexions sur le Principe sonore*, p. 207.)

As for the chord of the Dominant Seventh, this is formed in a different manner. It arises from the conjunction of the extreme terms of the triple proportion. Such a union in a single chord of the limits of the key-system brings about the absolute determination of the mode, or key.¹ This is exactly Hauptmann's position with respect to this chord: it represents the closing of the key-system, and the clear definition of the Tonic harmony as central harmony.

In forming, as he does, the chord of the Seventh by means of the addition of a fourth proportional, Rameau proceeds in much the same way as in the generation of the "*natural*" major mode, in which also the addition of a fourth term of the Fundamental Bass was necessary. It would therefore appear, he remarks, that there is no reason why the chord of the Seventh—whether of the form *c-g-b-d* or *c-e-g-b*—should not be considered to be as *natural* as the major mode itself. From these two chords we have obtained the minor tone *d-c*, and the diatonic semitone *b-c*. From the chord of the Dominant Seventh we obtain the major tone (8:9). This chord must also be regarded as a natural product, seeing that it is formed by the union of the extreme terms of the triple proportion. Dissonance, then, is the product of nature itself, and it also has its source in the one and only principle of harmony—the harmonic resonance of the sonorous body! Such is the opinion now expressed by Rameau. "How," he asks, "can the dissonances [the tones and semitones] which form the basis of the older systems of music, be considered to be the work of Art? Since Nature reveals herself harmonically only in the resonance of the sonorous body, how is it possible to derive these dissonances from another source? What blindness! If I have gone astray on this point in my first two works, have I not corrected myself in my later writings? I at least conjectured what I was unable fully to understand—the fault of not deriving from the principle all the consequences of which it was susceptible."²

¹ "On la voit cette dissonance se former entre les extrêmes d'une proportion triple: on ne la voit possible d'ailleurs que dans l'harmonie du conséquent, à laquelle se joint l'antécédant, pour lui servir de septième & s'unir, par ce moyen, avec lui pour rentrer ensemble dans l'harmonie de leur terme moyen, où cet antécédant prépare l'oreille à recevoir le sentiment du genre dont le mode annoncé doit être susceptible." (*Nouvelles Réflexions sur le Principe sonore*, p. 210.)

² *Ibid.*, pp. 206, 207.

It is not difficult to understand how these conclusions of Euler did not suit Rameau. But the latter, in his "*reply*" only demonstrated how badly he was equipped, chiefly through lack of the necessary scientific training, for entering the lists against such men as Euler. Rameau thinks that he furnishes a proof of the identity of octave sounds when he points to the fact that when men and women sing the same melody, they appear to sing the same sounds. He also states that the identity of Octaves is indicated by Nature, because, while in the resonance of the sonorous body the 12th and 17th are easily distinguishable, the Octave and 15th cannot be so distinguished. He says: "It should be remarked that the Octave cannot be distinguished in any sonorous body capable of being plucked, struck, or affected by vibrations of the air (*qu'elle ne se distingue jamais dans aucun corps sonore pincé, frappé, ou ému par le vent*), while on the other hand the 12th and 17th can be easily distinguished. The Octave changes in no way the nature of a sound, but, like the Unison, merely strengthens it; adding to it, however, greater brilliancy. . . . Is it not surprising that the $\frac{1}{3}$ and $\frac{1}{5}$ [12th and 17th] should be heard so distinctly, while the $\frac{1}{2}$ and $\frac{1}{4}$, the Octaves, are so to speak mute? Yet these Octaves really sound not less but more powerfully than the 12th and 17th. . . . and the reason why they cannot be distinguished is that they blend or coalesce so perfectly with the fundamental sound, which is that of the total sonorous body. . . . Hence we speak of the representation of a sound by its Octaves: in short, of the *Identity of Octaves*."

Rameau does not give any exact information as to the nature of the sonorous body in which the Octaves sound more powerfully than the 12th and 17th and yet cannot be distinguished. Nevertheless, his meaning is fairly clear. Octave sounds, although in the resonance of the sonorous body they are by no means "*mute*," but easily distinguishable, nevertheless unite or blend with the fundamental sound more perfectly than any other sound. But it does not follow that Octave sounds are identical: and Euler was quite justified in regarding the Octave as an interval distinct from the Unison. Rameau, on the other hand, rightly perceived that the resemblance between Octave sounds was so close that for all the practical purposes of harmony the one may be said to represent the other.

In the *Lettre aux philosophes, concernant le corps sonore et la sympathie des tons* (*Mémoires de Trévoux*, 1762), which is his last communication on the subject of harmony, Rameau pursues his reflections on the sonorous principle. It contains however nothing new, but merely recapitulates the principles with which we are already familiar. "Harmony is the gift of nature. The sonorous body vibrates and produces, besides its own sound, other sounds, from which arise two proportions: one geometrical, determined by the octaves; the other harmonic, and determined by the harmonics of the 12th and 17th." The harmonic proportion determines harmony; the geometrical proportion determines its succession. The remainder of the "letter" deals with the particular methods of instruction advocated by Rameau in his practical works treating of accompaniment and composition.

CONTEMPORARY CRITICISM OF RAMEAU'S DOCTRINES:

RAMEAU AND THE "ENCYCLOPÆDISTS."

As might be expected, the theories of Rameau did not escape criticism, even in his life-time. At first Rameau had the support of the *philosophes*, the "Encyclopædists," including d'Alembert, who, as is known, was the author of the little work entitled *Éléments de Musique théorique et pratique suivant les principes de M. Rameau* (Paris, 1752), generally described as a concise and lucid exposition of Rameau's theory of harmony. Rameau did not fail to thank d'Alembert for the service he had thus rendered him: "M. d'Alembert had done him the service of adding, to the solidity of his principles of harmony, a simplicity of which he indeed felt that they were capable, but which he himself had not been able to impart to them" (Letter to the Editor of the *Mercure de France*, May, 1752). Of d'Alembert's work, J. J. Rousseau remarks, in his *Dictionnaire de Musique* (Amsterdam, 1772): "Those who desire to see the system of M. Rameau, which in his various writings is so obscure and diffuse, explained with a simplicity and clearness of which one could scarcely have imagined it to be susceptible, should have recourse to the *Éléments de Musique* of

M. d'Alembert."¹ On the contrary, it may be affirmed that those who desire to acquire a knowledge of Rameau's many-sided theory and researches in the science of harmony need not expect to gain this by the perusal of d'Alembert's work. Its very lucidity and conciseness constitute from this point of view its principal defects. D'Alembert has pursued an eclectic method; his principal endeavour has been to weld Rameau's theories into a logical system—a somewhat difficult task; he selects, but he also eliminates, and that to a serious extent.

Towards the end of his life, however, Rameau was unfortunate enough to incur the disfavour of the "Encyclopædists," through causes which appear to have been political rather than personal. The result was that in several articles dealing with music which appeared in the French *Encyclopædia*,² Rameau found his theory of harmony assailed. To the articles in question, which were generally attributed to d'Alembert, but which more probably were the work of Rousseau, Rameau replied with *Erreurs sur la Musique dans l'Encyclopédie* (1755) and *Suite des Erreurs sur la Musique* (1756).

Against Rameau's theory of fundamental chords, and especially of "fundamental discords," Rousseau urged the following objections: M. Rameau requires the harmony, at least theoretically, to be full and complete. The result is that a great many of his dissonant chords are insupportable when all the notes are present. "The Italians on the contrary, care little for noise. A Third, a Sixth, skilfully used, even a simple Unison, when needed, pleases them better than all our *fracas*." But indeed M. Rameau, in the majority of his dissonant chords, does actually find it necessary, in order to render them supportable, to omit some of their sounds. The sound which has to be omitted is sometimes the Fifth. But according to M. Rameau, this Fifth is the support, the buttress of the harmony; how then can it be omitted? Again, M. Rameau does not inform one "where to take the dissonance, for he permits three kinds of harmonic successions: that by consonant chords only; that by dissonant chords only; and that in which both consonant and dissonant chords are interwoven with

¹ *Art. Système.*

² *Encyclopédie ou Dictionnaire raisonné des Sciences, des Arts, et des Métiers*, par une Société de Gens de Lettres. (Paris, 1751-80.)

each other." Rousseau further objects that "M. Rameau has pretended that Melody arises from Harmony." M. Rameau himself, however, ascribes different effects to the interval of the *Third* as compared with the *Fifth*; further, Accent and Rhythm, on which music depends for so much of its charm, do not owe their origin to harmony. To much of this criticism Rameau cannot well find a satisfactory answer.

On other points Rousseau shows himself less discerning, as for example when he remarks: "It appears, then, necessary to suppose that every dissonance should be resolved *downwards*; if there are any which resolve *upwards*, M. Rameau's instructions appear to be insufficient"; to which Rameau has no difficulty in replying that in his theoretical works he repeatedly lays stress on the fact that there are two kinds of Dissonance, the *major*, which resolves upwards, and the *minor*, which resolves downwards, and that he has explained in the clearest possible manner how both arise, and how they should be treated. Not infrequently, one observes that neither Rousseau nor Rameau quite understands the real nature of the subject he is discussing; as for example where the former expresses the opinion that "chords by supposition" are as susceptible of inversion as other chords; and where the latter does not observe that the chord of which he speaks—the chord of the Eleventh—is nothing but a simple 4-3 Suspension.

The *Suite des Erreurs sur la Musique dans l'Encyclopédie* is wholly taken up with an attack on Rousseau's article "*Enharmonique*," written for the *Encyclopædia*, and is mainly concerned with Greek theory. Rousseau had remarked: "As modern authors [Rameau] have expressed themselves somewhat vaguely on this subject, we consider it necessary to explain matters here a little more clearly." How, asks Rameau, has Rousseau done this? "Simply by copying, word for word, the article dealing with the subject in the *Génération Harmonique*!" Rameau, however, does not think much of Greek theorists, who regarded Thirds and Sixths as dissonances. He cannot understand the marvellous effects attributed to Greek music, as such effects could not be produced without the use of Thirds and Sixths! But we have seen that Rameau does not show to advantage as an authority on Greek musical theory.

On the whole, however, Rameau had little ground for complaint with regard to the articles on Music which appeared in the *Encyclopædia*. They followed, in the main, the theoretical principles he had already laid down in his various works, and demonstrated to a marked degree that whether or not Rameau's theory of harmony was to be regarded as an adequate and well-considered system, there was at least no other system worthy of being placed beside it. Thus in the article "*Scale*" (*Gamme*) d'Alembert—or Rousseau—not only accepts Rameau's explanation of the scale as arising from a Fundamental Bass of three terms (fundamental bass in Fifths), but also his theory of the "double employment of dissonance," the chord of the Added Sixth, the two-fold aspect which the sixth degree of the major scale may assume, and so on. Occasionally the writer of the articles considers it necessary to supplement Rameau's theory in some respects, and on such occasions generally comes to grief. For example, in the article entitled "*Fondamental*" he takes upon himself to explain the chord of the Augmented Sixth, of the form *f-a-b-d*♯. "This chord," he remarks, "is not in reality a chord of the Sixth; for from *fa* to *re*♯ [*f-d*♯] there is really a Seventh [!]. It is only custom which makes us persist in giving to this chord the name of augmented Sixth." The writer here considers that *eb* may be substituted at pleasure for *d*♯ without in any way altering the tonal significance of the chord, and, like not a few other theorists, is of opinion that temperament simplifies and reconciles all things! He should have imitated the wise example of Rameau, and avoided this chord as carefully as possible.

Again, while he agrees with Rameau that the chord of the diminished Seventh, for example *g*♯-*b-d-f*, has a Dominant "root," he feels constrained to add that "this chord is wrongly called a chord of the Seventh, for from *sol*♯ to *fa* [*g*♯-*f*] there is only a Sixth." He also considers it his duty to awaken musicians in general to the actual possibilities of harmony. "I am afraid," he remarks, "that the majority of musicians, some blinded by custom, others prejudiced in favour of certain systems, have not derived from harmony all that they might have done, and have excluded numerous chords which are capable of producing a good effect. To mention only a few of these, how is it that one never uses in harmony the chords *ut-mi-sol*♯-*ut*, and *ut-mi-sol*♯-*si*;

the first chord contains no dissonance, while the second chord contains but one" ! He admits that the first chord sounds somewhat harsh, but cannot discover the reason for this. He considers it to consist of major thirds added together, and asks: "How is it that harmonies which when heard separately please us, when heard together sound harsh? I confess I do not know, and I believe this is the best answer" !

The other chords to which he calls the attention of musicians are the following :—

$c-c\flat-g-b$	$c-c\flat-g\sharp-b\flat$
$c-c\flat-g\flat-c$	$c-c-g-a\flat$
$c-c\flat-g\flat-b$	$c-c-g\sharp-a$
$c-c-g\sharp-b\flat$	$c-c\flat-g\sharp-a$
$c-c\flat-g\sharp-c$	$c-c-g\flat-b$
$c-c\flat-g\sharp-b$	$c-c-g\flat-a\flat$

Here the list ceases ; a few other chords might have been added on the same principle ; no doubt at this point the ingenuity of the author became exhausted. Rameau might well have asked whether all this represented musical science, or whether it was not really some new game, perhaps suitable for a kindergarten ; and what was to be done with a musical theorist who was unable to discover any dissonance in the chord $c-c-g\sharp-c$!

Already, in 1753, in his *Lettre sur la Musique Française*, Rousseau, in comparing French with Italian music, to the detriment of the former, and especially of Rameau, who by this time had become recognized as one of the greatest composers of his age, had suggested that the most important factor in music and musical expression was Melody, and not Harmony, and that instead of Melody arising from Harmony it would be more accurate to say that Harmony had its origin in Melody. This was, for Rameau, an abominable heresy, and in his *Observations sur notre Instinct pour la Musique*, published in the following year, he subjects Rousseau to sharp criticism. The effect of music, Rameau begins, depends not so much on the transitions from grave to acute, from *piano* to *forte*, from slow to lively : these are feeble means. Harmony is the sole basis of music, and the cause of its greatest effect. He then proceeds to demonstrate, by means of the arguments familiar to us, that Melody

arises from Harmony, and also remarks: "If we sing a melodic passage as, *c-d-e-f-g*, we shall find that the small degrees of the scale are suggested by the consonances to which they pass. After singing the whole-tone *c-d*, one naturally ascends another whole-tone; because this gives us the consonance of the major third (*c-e*). Next, a semitone will be taken; one could not naturally sing a whole-tone, because this would give the augmented Fourth—a harsh dissonance. After this semitone, we next ascend a whole-tone, so as to arrive at the perfect Fifth. All this proves that Melody is based on the harmony of the sonorous body."

Rameau examines a passage from a work by Lully, and points to the different æsthetic effect produced by a transition to the Dominant, as compared with that to the Subdominant. He remarks that the effect of Lully's melody depends almost entirely on the harmony, and that the effect would remain even if the melody were made to fall where it now rises, and *vice versa*. He subsequently analyses a Recitative from Lully's *Armide* (*Ciel! qui peut m'arrêter!*), and shows that although it contains no accidentals, there is nevertheless much chromatic effect, that is, implied chromaticism resulting from the progression of the Fundamental Bass. Rameau's remarks are extremely interesting, and to a large extent also convincing. He speaks for example of Lully's masterly use of an interrupted Cadence where, although the sense of the words in *Armide's* Recitative is finished, *Armide* herself is not. The latter part of Rameau's *brochure* is taken up with a very keen attack on Rousseau, concerning the article *Lully*, written by the latter for the *Encyclopædia*.

The *Réponse de M. Rameau à MM. les Editeurs de l'Encyclopédie*, etc., concerns a notice which d'Alembert had prefixed to Volume VI. of the *Encyclopædia* in which he defends Rousseau from the attacks made upon him by Rameau. D'Alembert had remarked of Rousseau that "he joined to much knowledge of and taste in Music the talent of thinking and expressing himself with clearness and precision (*netteté*), a talent which musicians do not always possess." He reproached Rameau for having said that geometry was based on Music, and that in short the principle of Music influenced equally the other arts; that a "*clavecin oculaire*, which would illustrate the analogy between harmony and colours, would meet with general approbation," etc.

Rameau, in his reply, denies that he had asserted that geometry is based on Music. But he adds later: "I believe, however, that it would be much more easy to prove the possibility rather than the singularity of it." He then proceeds to restate the main points of his theory. He owes, he remarks, all his discoveries in music to the observation of the laws of Nature, as manifested in the sonorous body. "This is a whole divided into an infinitude of parts . . . from which there result, in the same instant—root, tree, branches, proportions, division, addition, multiplication, squares, cubes, etc."!

In the *Mémoires de Trévoux*, of August, 1735, appeared an article *Des Nouvelles Expériences d'Optique et d'Acoustique*, by the Jesuit R. Père Castel, in which an attempt was made to belittle Rameau's theoretical achievements, and to prove that he had merely developed somewhat the discoveries of his predecessors. Castel claimed that *Anathasius Kircher* (*Musurgia universalis sive ars magna consoni et dissoni*, etc., 1656), had discovered the Fundamental Bass before Rameau. "Kircher teaches that a true bass should proceed by a 4th, a 5th or an 8th (*Quarta vox Basis, vulgo Bassus . . . ita dictus, quod in eum, tanquam in Basin, omnes inclinent voces. . . . Gaudet intervallis gravioribus, grandioribusque, Quarta, Quinta, et Octava: in natura rerum respondet telluri*)." Castel proceeds to argue that Rameau, in admitting three fundamental sounds in each key—on the first, the fifth, and even the fourth degrees of the scale—loses sight of the unity of Nature; that he contradicts his principles in making the Subdominant the bass of a chord which is not fundamental—the chord of the Added Sixth. In the chord C—*g-b-d-f*, Castel argues that the sound *c* is not merely the fundamental sound by "Supposition," but that it, and not *g*, is the real fundamental. He refers to *Musettes* in support of his contention: in these *Musettes* one finds the Tonic sustained throughout (Tonic Pedal). It is through the Tonic that one understands the other degrees of the scale, and this is proved by the fact that these degrees have received names which indicate their relationship to the Tonic.

Rameau's reply appeared in the following year (*Lettre au R. P. Castel, au sujet de quelques nouvelles réflexions sur la musique*—*Mémoires de Trévoux*, July, 1736). He takes Castel to task for his somewhat belated discovery of the real

significance of Kircher's reference to the harmonic bass. "This is not the time, Rev. Father . . . to expound the proper interpretation which ought to be given to the rules you quote from this author." The language of Kircher, he remarks, is merely an echo of a passage from Zarlino, which is quoted in the first chapter of Book II. of the *Traité de l'harmonie*. Kircher gave no determined progression to his bass; it could receive indifferently the perfect chord, the chords of 6 or $\frac{6}{4}$, or of the 2nd, 7th or 9th. He made no distinction between the Fundamental Bass and the *Basso Continuo*, citing, as fundamental, chords which were "derived" (inversions), and again, as "derived," chords of whose fundamental he was ignorant. Kircher, in short, had no acquaintance with the principle of harmonic inversion.

As for Castel's contention that the fundamental of such a chord as C—*g-b-d-f*, is *c* and not *g*, Rameau replies that this no doubt is an ingenious theory, namely, that the sonorous body is the foundation of all the sounds of the mode; but if Castel admits, as he does, that the fourth degree of the scale is incommensurable; if it is not found as an aliquot part of this same body, and if it is the same with regard to the minor Third, the Sixth, etc., Rameau then fails to see how it can serve as the foundation of all the sounds of the mode. The union of *c* with *g-b-d-f* arises from another principle, which, however, is only a consequence of the first. We hear *c-c-g* in the resonance of the sonorous body, and it is from these sounds, again, that *b-d-f-a* arise. But all these sounds cannot be heard together. Rameau adds that he will deal with the points raised by the *R. Père* in his work the *Génération Harmonique*, which he is about to publish.

In a pamphlet entitled *Nouvelle Découverte du Principe de l'harmonie, avec un Examen de ce que M. Rameau a publié sous le titre de "Démonstration de ce Principe,"* by "M. Esteve, de la Société Royale des Sciences de Montpellier" (Paris, 1752), Rameau's theories as to the physical nature of musical sound are subjected to some criticism. "M. Rameau has said that every sound which is composite, which includes within itself several other sounds [harmonics] is a musical sound; but that every sound which is simple produces on the ear the effect of noise." M. Rameau, however,

avails himself of three harmonics only, and does not mention the others. But if M. Rameau makes use of harmonic sounds for his principles of harmony, he ought to make use of them all: for he is not at liberty to select a few and neglect the others.

Especially noteworthy is the fact that M. Esteve here brings forward a new theory of Consonance. He does not agree with Descartes, who has said that the agreeable sensation we experience from consonance is owing to the fact that the soul takes pleasure in simple relations. "If the soul," he remarks, "distinguishes consonance from dissonance only when it is attentive to compare sounds (as $1:2$ = Octave; $2:3$ = Fifth, etc.), then why is it not conscious of this operation"? This sounds like a passage from Helmholtz. But indeed, Esteve presents us with a theory of Consonance that is *nothing more nor less than the theory of consonance propounded by Helmholtz*. Consonances are such, and therefore pleasing to the ear, because their harmonics are reinforced; that is, consonance is determined by the coincidence of the upper partial tones—or of some of these tones—of the two sounds forming the consonance. With dissonance, on the other hand, there is no such reinforcing or coincidence of the harmonics: instead, these clash with one another. M. Esteve then examines the varying degrees of consonance of the different intervals, determined by the coincidence, or otherwise, of the upper partial tones. He gives the following table:—

Table des Harmoniques des Consonances.

Funda- mental ..	ut	ut	sol	ut	mi	sol	si	ut	ré	mi	fa	sol
Octave ..	ut	ut		ut		sol		ut		mi	fa	sol
Fifth ..	sol		sol	ré		sol	si	ré				
Fourth ..	fa		fa	ut		fa	la	ut				

The imperfect consonances, as well as the dissonances, he compares in a similar way. Esteve refers to *M. Sauveur* "who has proposed another principle of harmony"; the essence of which is *that dissonance finds its physical explanation in the presence of beats*, while consonance is marked by the

absence of such beats!¹ The words used by M. Sauveur, and quoted by Esteve, are: "In pursuing this idea, we find that the chords in which beats are not heard are Consonances; and that those chords in which the beats are strongly felt, are Dissonances; and that *when a chord is a dissonance in a certain octave, AND A CONSONANCE IN ANOTHER* [!] *the reason is that it beats in the one and not in the other.*" Here we find in the middle of the 18th century the whole Helmholtzian theory of Consonance completely developed.

¹ Cf. also Rameau's remarks on this subject, p. 157. Rameau, however, does not regard beats as the explanation of, but merely as incidental to, the phenomena of Consonance and Dissonance.

PART III.

CHAPTER X.

DEVELOPMENT OF THE THEORY OF HARMONY FROM THE
TIME OF RAMEAU UP TO THE PRESENT DAY.

TARTINI'S *TRATTATO DI MUSICA*.

THE theories of Rameau, notwithstanding much opposition and criticism, gained a widespread influence, even during his life-time. His *Traité de l'harmonie* was translated into several languages. Even Rousseau, in his *Dictionnaire de Musique*, found himself obliged to adopt, for the articles dealing with the subject of harmony, the theoretical principles of Rameau. Rousseau however could not refrain, even in his dictionary, from making a slighting allusion to the man whose principles he was willing enough to borrow. "I have treated," he says, "the part dealing with harmony according to the system of the Fundamental Bass, although this system, imperfect and defective as it is in so many respects, is not based in my opinion either on Nature or truth. . . . Still, it is a system. It is the first, and the only one up to that of M. Tartini, in which an attempt has been made by means of definite principles to connect the innumerable isolated and arbitrary rules which made of the Art of Harmony a task for the memory, rather than a matter for the reason. The system of M. Tartini, although in my opinion superior, is not yet generally known, and does not enjoy, at least in France, the same authority as that of M. Rameau. . . . I have therefore thought fit to defer to the nation for which I write, and to prefer its opinion to my own [!] as to the real foundation of the theory of harmony." (*Preface*.)

Thus Jean Jacques, the apostle of truth!

To trace the influence of Rameau on his successors is to trace the history and development of the theory of harmony from the middle of the eighteenth century up to our own day. In order to accomplish this, however, in any adequate manner, a volume—perhaps more than one—would be necessary. Nevertheless, some mention must be made of the most important developments which the theory of harmony has undergone since the time of Rameau.

One of the most remarkable works ever written on the subject of harmony is that of Giuseppe Tartini, the celebrated Italian violinist and composer, namely, *Trattato di Musica secondo la vera scienza dell'armonia*, published in 1754. Tartini, like Rameau, takes as the starting-point of his theory of harmony the acoustical phenomena resulting from the resonance of a sounding body of musical character. The first portion of his work strongly recalls the *Propositions* and *Expériences* of the first part of Rameau's *Génération Harmonique*. Thus Chapter I. is entitled, *De Fenomeni Armonici, loro natura, e significazione*.

After referring to the sounds produced by such sonorous bodies as those of the stretched string of the monochord or *cembalo*, the marine trumpet, the orchestral trumpet and horn, organ pipes, etc., Tartini remarks:—"The stretched string of the monochord, which in itself ought to produce a single sound, has clearly three sounds," namely, the fundamental sound, 12th and 17th. "The marine trumpet, the orchestral trumpet and horn, exhibit the same uniform phenomena: it is physically impossible for these instruments to produce other sounds than those of the harmonic series, corresponding to the fraction 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, etc."¹

Tartini then examines the nature of the vibration of the different segments into which a string of the monochord may be divided. Suppose that the string A-B is divided into two equal parts at the point C. $\frac{\frac{1}{4}}{A} \frac{\frac{1}{3}}{E} \frac{\frac{1}{2}}{D} \frac{\frac{1}{3}}{C} \frac{\frac{1}{4}}{F} \text{---} B$ The vibrations of A-C will pass with equal velocity into C-B, which is equal to A-C: will return from the point B through B-C into C-A; then back again from A-C to C-B; and this will continue as long as the string vibrates. If the string be divided into three equal parts (as at D and F) then the

¹ *Trattato di Musica*, Ch. I.

vibrations of A-D will pass into D-F, thence into F-B, and back again, and so on *ad infinitum* as long as the string vibrates. Similarly with the division into four equal parts, as at E. It is physically impossible that any segment which is incommensurable with the string in its totality can form any part of its tone, because it will interfere with and finally destroy the vibrations of the other segments which are commensurable with the prime tone produced by the entire string.¹ Then the sounds of instruments such as the marine trumpet being physically impossible unless these sounds be in the harmonic series, in this sense, and from the point of view of harmonic unity, they are true physical monads.² In this respect also the name of Aliquot part signifies nothing; the name of Unity everything.

One now begins to perceive the nature of the conception which has inspired Tartini's theory. Throughout his whole work there is the most direct internal evidence that he has studied and assimilated not only the theories of his countryman Zarlino, but especially those of Rameau: in particular, the *Traité de l'harmonie* and the *Génération Harmonique*. In the *Traité*, almost the first express declaration of Rameau is that "Unity is the principle of harmony," that is, the consonances proceed from Unity as from their source. In the *Génération Harmonique* Rameau's first task is to prove that harmony has its origin in the resonance of the sonorous body. But while Rameau makes it his principal endeavour to demonstrate that sound is in its nature not simple but complex, not uniform but multiform, Tartini's object is to prove that harmony presents us, not with a diversity, but a uniformity; all must resolve itself into Unity: all is Unity. Rameau has said that musical sound is not *one* but *three*; Tartini demonstrates that the sounds of harmony (harmonic series, fundamental note, 12th and 17th), in themselves real harmonic monads, are not *three*, but *one*.

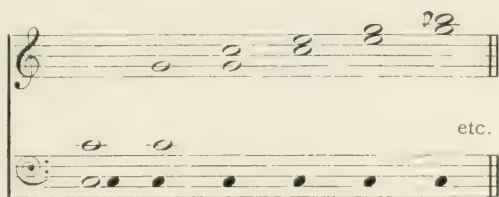
But in doing this, Tartini does not set himself in opposition to the principle of Rameau. He accepts it, and regards the two principles, that of Unity breaking itself up into a series of harmonic monads, and that of these monads resolving

¹ *Trattato di Musica*, Ch. I, pp. 11, 12.

² "E in tal senso, e rispetto le unità armoniche, sono vere monadi fisiche." (*Ibid.*, Ch. I, p. 12.)

themselves into Unity, as complementary principles, of equal importance and of equal significance for the theory of harmony. For him indeed they are one and the same. "Therefore," he remarks, "the harmonic system reduces diversity to uniformity, multiplicity to unity; and, given a simple Unity, this divides itself harmonically. Then the harmonic system must, in every respect, be regarded as Unity; rather the harmonic system resolves itself into Unity, as into its principle. This is a legitimate consequence, and is physically demonstrable; it is, indeed, independent of the human will" (*e però affatto indipendente dall'arbitrio umano*.—*Trattato di Musica*, Cap. I, p. 13.)

Tartini then proceeds to demonstrate the existence of a remarkable acoustical phenomenon which, he considers, confirms in a striking manner the truth of his theory, namely, the "combination tones." "One has discovered," he says, "a new harmonic phenomenon, which proves in a wonderful way the same thing, and indeed much more." If, he points out, two sounds of just intonation be sounded clearly and loudly together, there will result a third sound, lower in pitch than the other two, and which will be the fundamental¹ sound of the harmonic series of which the first two sounds form an integral part:—



Resultant sound.

It is from the principle of Unity and from this phenomenon of "the third sound" (*il terzo suono*) that Tartini develops his theory of harmony.

¹ Tartini, however, does not here say *fundamental*, but *octave* of the fundamental, corresponding to the term $\frac{1}{2}$, and in the examples he gives of the resultant "third sound," places it an octave too high. This mistake he afterwards corrected.

Zarlino's explanation of this interval as "composite," consisting of a minor Third and a perfect Fourth. Tartini also makes the mistake of imagining that the Octave produces no resultant sound. At the same time, he is aware that the "third sound" may result from inharmonic as well as harmonic intervals. Thus, if d'' be sustained on the violin, while g'' , the fourth above, be gradually approximated to f'' so that several inharmonic intervals must result, the "third sound" will be found to descend gradually a major sixth, from g to $b\flat$:—



The point of principal importance, however, is that any two consecutive sounds of the harmonic series will when sounded together produce the same resultant tone, this tone invariably corresponding to the octave of the fundamental tone. Observe carefully then, says Tartini, that we find this octave, that is $\frac{1}{2}$, established as the *physical root* or origin of the harmonic system.¹

This settled, Tartini proceeds to develop his system in a remarkable fashion. Seeing that the sonorous body in vibrating divides itself into an infinite series of harmonic sounds; seeing that any two consecutive sounds of this series invariably produce, in turn, the same "third sound," music must therefore be regarded as a physical science. Again, as the series of sounds which naturally arise from the resonance of the sonorous body corresponds to the harmonic progression $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}$, etc., which progression must be regarded, at least theoretically, as continued to infinity, it is evident that this series of natural harmonic sounds is

¹ " Intanto per mezzo di tal fenomeno resta fisicamente stabilita la unità costanté in infinito in $\frac{1}{2}$, come radice fisica del sistema armonico." (*Trattato di Musica*, Cap. I.)

mathematically determined. The same is true of the "third sound." Music therefore must be regarded as a physico-mathematical science. It is necessary to consider it in both these aspects. Acoustical phenomena are in themselves mere isolated facts, without connection; while mathematical or geometrical demonstrations may have no connection with the subject of music. Some connection must be established between them. For the deduction of definite principles of musical science geometrical demonstrations are therefore necessary, but only such as can be derived from the physical facts themselves.

The straight line, divided harmonically, easily lends itself as a representation of the sonorous body and of the diverse elements constituting harmony; but the Unity into which these diverse elements resolve themselves—how can this be represented? For this another kind of geometrical figure is necessary, which Tartini concludes can only be the circle. Further, as the straight line must be regarded as antecedent, both mathematically and physically, to the curve, and as the circle is itself impossible without the supposition of the straight line, the circle must be regarded as inscribed in a square. The sonorous body will represent the diameter of the circle. The radius of the circle, therefore, which is half of the diameter, is half of the sonorous body, that is $\frac{1}{2}$, which Tartini has demonstrated is the physical root of the harmonic system. It is unnecessary to follow Tartini into the abstruse calculations into which he now plunges, especially those in which he attempts to prove, unsuccessfully, that the system of harmony arising from the *senario* is a harmonic system complete in itself, and that the complex of consonances must be regarded as being terminated by the number 6. It is deplorable that Tartini, one of the most gifted of theorists and musicians, and who intellectually at least was Rameau's superior, should have taken as the foundation of his system and of his geometrical demonstrations what was in reality nothing more than the faulty observation of an acoustical phenomenon. For Tartini places the resultant tone an octave too high; it corresponds not to the sound produced by the half of the sonorous body, but to that produced by its whole length. Not the half of the string but the whole, that is, the fundamental itself, as Tartini might have suspected, is the "physical root," in Tartini's sense of the term, of the

harmonic system. The entire string, therefore, should represent the radius of the circle of which the diameter is twice the radius, that is, twice the length of the sonorous body!—a result which would have considerably embarrassed Tartini.

Although Tartini is an original and independent thinker, the main conclusions at which he arrives bear a striking resemblance to the theoretical principles formulated by Rameau. It is perhaps owing to Fétis, who has given a critique—very inadequate—of Tartini's theory of harmony (*Esquisse de l'harmonie*), as well as to Rousseau (*Art. Systématique, Dict. de Musique*), that Tartini's theory has frequently been represented as the antithesis of that of Rameau. It may be asserted however, on the contrary, that in the *Trattato di Musica* we find a notable attempt to demonstrate, on scientific and mathematical principles, the correctness of the theoretical conclusions which Rameau had already endeavoured to establish.

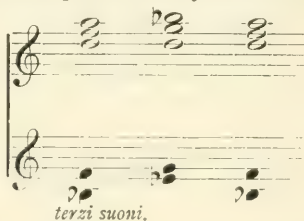
For Tartini, as for Rameau, the harmonic division of the sonorous body is the principle of harmonic generation. From this we obtain the major harmony. The minor harmony, which corresponds to the arithmetical division, is an inverted major harmony. These constitute the sole positive harmonic unities of the musical system. If $\frac{1}{3}$, that is the "third sound," and the octave of the fundamental, is the "physical root," the Fifth is the determining constituent of the harmonic system. If the Octave be represented by the ratio $12 : 6 (= 2 : 1)$ its harmonic and arithmetical division will be represented respectively by the numbers $8 : 9$. The product of these two numbers, Tartini points out, is as the product of the two terms $12 : 6$, which here represent the proportion of the octave. This is the mathematical result. But the physical result is the same. For the terms $8 : 9$ are successive terms of the harmonic series, and if sounded together there will result the "third sound" which is represented by $\frac{1}{3}$, and equally by the duple proportion (*ragione dupla*) $12 : 6$. These are facts which need not be too closely examined; it is sufficient to show that without doubt one of the main objects of Tartini in his geometrical demonstrations is to prove that the arithmetical as well as the harmonic division of the Octave, and also of the Fifth, is a necessity of the harmonic system. The harmonic division of the Octave

and Fifth causes no difficulty, for Nature herself divides these intervals harmonically, thus :—



But with the arithmetical division of the Octave and Fifth, this is not the case ; such a division would appear to be a contradiction of Nature.

Rameau's difficulties are then also those of Tartini, namely, the explanation of the Subdominant, and the origin of the minor harmony. Like Rameau, Tartini considers that only the major harmony (*sistema armonico*) is given directly by Nature. This is proved by the "horrible effect" of the resultant tones produced by the minor harmony :—



Although it is true that all harmonic music is based on the two diverse genera of major and minor, and although the minor harmony, corresponding as it does to the arithmetical proportion, would appear to arise from a principle which is the opposite of that of the harmonic, it nevertheless is impossible to consider that one and the same musical system arises from two diverse principles ; this would be absurd, and contrary to the very idea of a system.¹ The minor

¹ " E benchè si confessi, che l'armonia di terza minore, come dedotta dalla divisione aritmetica, sia quasi presa in prestito dalla scienza aritmetica : e si confessi, che il sistema armonico sia per natura l'unico, e per eccellenza il primo, nulladimeno vi è il debito in chi si propone di formare un sistema universale di abbracciare i due generi diversi del sistema, e ridurli ad un genere solo, che sia l'universale. Altrimenti nello stesso sistema vi saranno due principi diversi, il che è assurdo, e si oppone alla vera idea di sistema."—(*Trattato di Musica*, p. 66.)

harmony cannot be regarded as foreign or accidental to the musical system; on the contrary, the minor harmony arises from the same principle as the major, and is inseparable from it.¹

Tartini demonstrates as follows:—



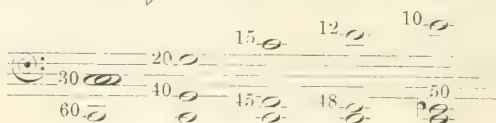
Here it is certain that all the intervals in the upper stave are harmonic intervals and derived from the harmonic series. It is equally certain that the "third sounds" which respectively arise are the physico-harmonic roots of these intervals. All then is harmonic, and derived from the harmonic system. Nevertheless it will be observed that the resultant sounds are in arithmetical progression, and produce the minor harmony *f-a \flat -c*. The arithmetical system therefore is the inseparable consequence of the harmonic system. Such facts would appear to indicate, at least, that the minor is an inverted major harmony. By no means however can they be regarded as furnishing an adequate explanation of the origin of the minor harmony. If it is true that the intervals in the upper stave are harmonic, and that they succeed one another in the order determined by the harmonic series, it is equally certain that they do not belong to one and the same harmonic system, but are derived from different systems. They are related to different fundamentals, and are strictly speaking in different keys. Thus the Fifth is related to *c* as its fundamental, or harmonic centre, the Fourth to *F*, the major Third to *C*, the minor Third to *A \flat* . But Tartini's object is to demonstrate that the minor system arises from one

¹ "Che l'armonia di terza minore si è presa in prestito dalla scienza aritmetica e sia quasi straniera, e accidentale alla musica, ciò nego assolutamente: e per lo contrario dico, che il sistema dell'armonia di terza minore non solo è inseparabile dal sistema dell'armonia di terza maggiore, ma anzi è lo stesso identico sistema."—(*Trattato di Musica*, p. 68.)

and the same harmonic system, and not from a series of intervals derived from different harmonic systems.

Further, from such a series of intervals Tartini might deduce all that he requires, and much more, without any necessity to have recourse to the resultant tones. For here we find, not only the harmonic division of the octave $c'-g'-c''$, but also the arithmetical division $c'-f'-c''$; and not only the harmonic, but also the arithmetical division of the Fifth, thus:— $c'-e'-g'—c'-e\flat'-g'$.

Tartini puts the matter in another way. Let C, the fundamental note of the harmonic series, = 60. The next five sounds of this series will be represented respectively by the numbers 30 : 20 : 15 : 12 : 10, of which the complements are 30 : 40 : 45 : 48 : 50, represented respectively by the notes $c : G : F : E : E\flat$:—



Tartini here considers the lowest sound to represent the Fundamental Bass of all the harmony heard above it.¹ The sounds of the harmonic series which arise successively above it determine not only the major harmony and the major system, but also the minor harmony and the minor system; for here we find not only the Octave arithmetically divided ($C-F-c'$), but also the Fifth ($C-E\flat-g'$). Once more, therefore, it is evident that the minor harmony results as the necessary consequence of the major. But Tartini cannot possibly consider the sound C to be the Fundamental Bass of the Fourth $C-F$, or of the minor Third $C-E\flat$, for he has already demonstrated that the resultant and fundamental sound of the Fourth $C-F$, is not C, but F; and that the fundamental of the minor Third $C-E\flat$, is not C, but $A\flat$.

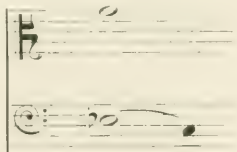
Further, if the sixth harmonic sound $\overset{10}{g'}$ corresponds to $\frac{1}{6}$ of the whole string represented by $\overset{60}{c}$, then its complement $\overset{50}{E\flat}$

¹ "Ma acciò meglio s'intenda tuttocìo praticamente, si supponga C solfaut 60 Basso fondamentale di tutta l'armonia, come lo è in fatto."—(*Trattato di Musica*, p. 70.)

corresponds to $\frac{2}{3}$ of the string. But this sound cannot be produced by the string, for it is not an aliquot part: Tartini has himself demonstrated in the most convincing way that such a sound is "physically impossible."

Nevertheless, Tartini's researches as to the origin of the minor system are important and valuable. He does not, like Rameau, relate the minor harmony to the co-vibration of the multiples, but regards it as arising from the same principle as the major, which was the view taken by Rameau himself in the latter part of his *Démonstration* and *Réflexions sur le principe sonore*. The minor system is then related to the major system, and is inseparably connected with it. Also, it is important to observe, Tartini considers the lowest note of the minor harmony to be the fundamental note. Thus, in the minor harmony $c-c\flat-g$, c is the "principal bass"; it is the generator of all the notes of the harmony heard above it. But this harmony has a *secondary bass*, namely $c\flat$, for this $c\flat$ is the bass of the harmony of the major third g , which determines the major system.¹ This is also the view taken by Rameau in his *Démonstration*. But there is this curious difference between the results arrived at by these two distinguished theorists. While Rameau considers that the minor harmony generated by the fundamental note C —for, as we have seen both theorists regard the minor

¹ "Posto E lafà (secondo la propria natura di mezzo aritmetico della sesquialtera, o sia quinta già altrove dimostrato) a confronto di C solfaut gravissimo, come Basso fondamentale costante, e a contronto dello stesso G solreut dell' esempio :—



si trova E lafà seconda basse di armonia di terza minore, di cui è prima base C solfaut Basso costante. Dunque resta dimostrato, che E lafà include in se stesso le due armonie di terza maggiore, e di terza minore."—(*Trattato di Musica*, pp. 110, 111.)

and the major system as proceeding from one and the same fundamental note—to be *a-C-c*, Tartini considers it to be *C- \sharp -g*. Nevertheless, Tartini does not consider C minor to be the relative minor key of C major. This conclusion however would appear to be forced upon him, even if he insists, as he does, that C minor is the relative minor of *E \flat* major. Further, in making *g* to be a doubly determined note, that is, Fifth of C and major third of *\sharp c*, the minor harmony appears to arise from two fundamental sounds, and two generators. This does not help us to understand how the minor, like the major harmony, impresses us as a harmonic unity.

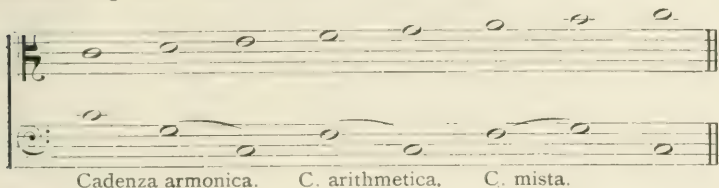
These are for Tartini the central problems of the science of harmony. All his demonstrations are in the main directed towards one object, namely, to prove that the Octave is the “physical root” of the harmonic system, and that the arithmetical as well as the harmonic division of the Octave and of the Fifth, is a necessity which arises from the nature of the harmonic series itself. From this two-fold division of the Octave we obtain all that is necessary for the formation of the diatonic system, the scale and harmonic succession. From the two-fold division of the Fifth there arise the two diverse harmonic genera—the major and minor harmonies. Like Rameau, therefore, Tartini’s fundamental bass is a Fundamental Bass in Fifths, and consists of three terms, Tonic, Dominant, and Subdominant. Each of these sounds may bear the complete major harmony (*sestupla armonica*): these three harmonies are the principal harmonies of the Mode, and from them we obtain all the sounds necessary for the formation of the major scale. The Fifth, then, is that portion of the harmony which determines the harmonic system and the nature of the Fundamental Bass.¹ “The scale therefore proceeds from the harmony, and not the harmony from the scale.”²

Tartini distinguishes three principal Cadences: (1) the Harmonic (Dominant-Tonic); (2) the Arithmetical (Subdominant-Tonic), and (3) a “mixed cadence” (*Cadenza-Mista* = Subdominant-Dominant). It follows from his method of dividing the Octave arithmetically as well as harmonically that he finds no difficulty in allowing the immediate succession

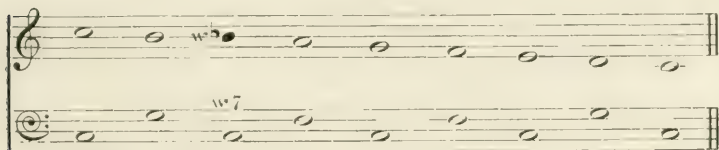
¹ *Della Scala*, Cap. 4., p. 98.

² *Ibid.*

of the two Dominants. Thus the fundamental bass to the ascending scale is as follows :—



But this only in the ascending scale (which naturally ascends, rather than descends, being derived from the ascending harmonic series). The immediate succession of the two Dominants in ascending is good, because in this case we have the progression from the imperfect (arithmetical) to the perfect (harmonic). But the reverse succession is faulty, for here we find the progression from the perfect to the imperfect. Nevertheless, the three terms of the fundamental bass may still serve as the basis of the descending scale, by the mediation of the "natural Seventh"! (*Fa enarmonico*) :—

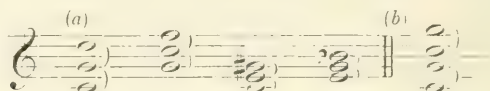


In Chapter 5 (*De' Modi, o siano Tuoni musicali antichi e moderni*) Tartini enters into an examination of this natural Seventh, the conditions under which it might be employed, with many references to the enharmonic system of the Greeks. This Seventh is *consonant*, being derived from the harmonic series; it is for this reason, he thinks, that the Dominant Seventh, which so closely resembles the "natural" Seventh, does not require to be prepared. It is, then, not an "unprepared discord," but a consonant chord.

While the harmonic and arithmetical progressions are consonant, the geometrical progression is dissonant. In the geometrical progression is found the origin of dissonances,

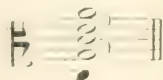
and of dissonant chords. "The nature of geometrical quantity is substantially opposed to that of the harmonic and arithmetical proportions . . . because the latter are based on an infinite series of *diverse* ratios, while the former is based on an infinite series of *similar* ratios." It would appear, then, that a chord composed entirely of Octaves must be dissonant, because it arises from the geometrical progression $1:2:4$, etc. Tartini however will not grant this, although he remarks that Octaves are consonant "more through custom, than reason" (*più per uso, che per ragione*).

We therefore find the following rule (*il quinto Canone musicale*):—"Every chord is dissonant which contains two similar intervals of different species, except the octave."¹ Therefore two Fifths, two Fourths, two major or minor Thirds will produce dissonant combinations, thus (a):—



On the other hand, the chord at (b) is consonant, because both Fifths are of similar species, that is, they belong to the same harmonic series. Of two intervals of different species which form a dissonant chord, that interval will be consonant which is in its right place in the harmonic series, while the other will be dissonant. Thus in the chord of the Dominant Seventh *g-b-d-f* we find two minor Thirds *b-d*, and *d-f*; the first is consonant, because it is in its natural place in the harmonic series of which *g* is the fundamental, but the second is dissonant, because it does not belong to this series. Therefore *f* is and remains the dissonant note, no matter what forms the chord may assume.

Again, in the chord of the Added Sixth—not so called however by Tartini—it is the Sixth which is the dissonance. The chord should be understood thus:—



¹ *Trattato di Musica*, p. 74.

Here there are two Fourths of different species: the first Fourth $g-c'$, is consonant, because it belongs to the harmonic series of which c is the fundamental; it is the second Fourth $e'-a'$, which is dissonant. In the chord $c-e-g-a$, it is a , therefore, which is the dissonant note.

It is evident that Tartini's theory of dissonance is not one which can lead to any satisfactory result. Nor is he able to draw any effective distinction between consonance and dissonance. He appears here to be at the mercy of his system. Besides, in the chord just mentioned, which is a Subdominant discord, Tartini imagines that there are two perfect Fourths. Here however he errs; for if the first Fourth $g-c'$ ($= 3 : 4$) is perfect, the second $e'-a'$ ($= 20 : 27$) is not. So also with the chord of the Dominant Seventh, $g-b-d-f$, in which he considers there are two minor Thirds $b-d$, and $d-f$. But $d-f$ ($= 27 : 32$) is not a minor Third.

Tartini's seventh "rule" is that "there can be no dissonant chord which is not based on a consonant one." This follows from the fifth rule, and also from his explanation of the major and minor harmonies as containing in themselves the sole positive and constitutive elements of harmonic composition. Thus in the chord $c-g-d'$ both Fifths $c-g$ and $g-d'$ are harmonic, although together they form a dissonance. This "rule" is of extreme theoretical importance. But Tartini does not observe that it cannot apply to the two most characteristic discords of the harmonic system. For, in the chord of the Dominant Seventh $g-b-d-f$ the Third $d-f$ ($27-32$) is not a harmonic interval. It is in itself dissonant, and cannot therefore be derived from a consonant chord. Likewise with the chord of the Added Sixth. In Tartini's system we meet again with difficulties similar to those with which the works of Rameau have already made us familiar.

Tartini's work, however, is that of a superior intellect. It is a reasoned, logical, and closely-welded system, based on philosophic and scientific principles the like of which we do not again meet with until we come to Moritz Hauptmann's *Harmonik und Metrik*.

Although Tartini is generally regarded as the first to discover the combination tones—he had asserted that as early as 1717 he had made use of them for the purpose of teaching pure intonation on the violin to his pupils—it is certain

that other musicians had discovered them independently. *J. A. Serre* of Geneva, and *Romieu* of Montpellier, had given accounts of these tones before Tartini's publication of the *Trattato di Musica*. Serre is the author of a not unimportant work on harmony, *Essais sur les Principes de l'harmonie* (1752), in which he has to a certain extent anticipated Tartini's treatment of the combination tones as a basic principle of the science of harmony. In other respects he adopts, in large part, the principles of Rameau. Serre also wrote *Réflexions sur la supposition d'un troisième mode en musique* (*Mercur de France*, 1742), in which he criticizes the theory of a *pure minor mode* advanced by *C. H. Blainville* (*Essai sur un troisième mode*, 1751). Blainville demonstrated that the pure minor mode was exactly the reverse of the major mode; it is to be regarded not in an ascending but a descending aspect, in which case the order of tones and semitones is exactly that of the major mode. This

$$\text{Major} = c - d - e - f - g - a - b - c'$$

$$\text{Pure Minor} = e' - d' - c' - b - a - g - f - e$$

theory of a "pure minor mode" has in our own day gained considerable prominence, principally through the writings of Dr. Riemann.

G. A. SORGE.

A work of considerable theoretical importance is that by *Georg Andreas Sorge*, entitled *Vorgemach der Musikalischen Komposition*, etc. (1745-1747). In this work, published nine years before Tartini's *Trattato di Musica*, Sorge demonstrates his acquaintance with the phenomenon of the combination tones.¹ In the *Preface* to the first part of his work, Sorge puts the question, Why do we prefer this succession of sounds *c-d-e-f-g-a-b-c'*, rather than *c-d-e-f-g-a-b-c'*, or *c-d-e-f#-g-a-b-c'*? Because, he answers, the sounds in the first order are the most closely related to the perfect (major) harmonic triad. The first, third, and fifth sounds are

¹ "Ja so gar zwey Flutes douces geben, wenn man *c* und *a* rein zusammen bläset, noch den dritten Klang, nemlich ein *f*."—(Von dem natürlichen Zusammenhang der Consonanten. Ch. 5.)

derived from the major triad *c-e-g*, and the other four sounds are related in the closest way to the three sounds of this triad; for *d* is Fifth of *g*; *f* is the Fifth below *c*; while *a* and *b* are respectively the lower and upper Fifths of the Mediant *e*. It is thus we obtain the major scale; each sound of the major triad *C-e-g*, requires a Fifth both above and below it; thus the Fifths above and below *c* are *g* and *f*; those above and below *e* are *b* and *a*; while those above and below *g* are *d* and *c*. On the other hand the *b♭*, in the other order of sounds, can boast of no such close relationship with the three essential sounds, but is the lower Fifth of the lower Fifth of *c*. So also *f♯*, in the third scale, is the upper Fifth of the upper Fifth of *c*. Likewise in the Minor Mode: the order *d-c-b♭-a-g-f-e-d*, arises out of the *Trias minus perfecta d-f-a*. *c* is upper Fifth of *f*, and *b♭* is its lower Fifth; while *g* is lower Fifth of *d*, and *e* upper Fifth of *a*.

GENERATION OF CHORDS.

Sorge repeats this statement later (Ch. II, p. 28)¹ and proceeds:—"Of these seven degrees, the three which make up the determining (*herrschenden*) triad *c-e-g*, are the *essential sounds*." He then distinguishes the following "triads,"

¹ Dr. Riemann (*Geschichte der Musiktheorie*, p. 442) quotes the statement here referred to, to which he gives the following illustration:—

$$\begin{array}{c} g - b - d \\ C - e - g \\ f - a - c \end{array}$$

which however is not given by Sorge: and makes it appear, indeed explicitly asserts, that Sorge in this passage recognises that the major scale is composed of the elements of the three major chords, that is, Tonic, Dominant, and Subdominant. In such a case, then, *b* must be regarded as the Third of *g*, and *a* as the Third of *f*. But this is to contradict Sorge himself, who says nothing of a Third-relationship. The complete passage in Sorge's work (p. 28) referred to by Dr. Riemann, is as follows:—"Wir können auch sagen. . . denn ein jeder Theil dieser Triadis verlangt eine reine Quint unter und über sich. Da hat nun Sonus infimus *c*, *f* unter sich, and *g* als partem triadis, über sich: Sonus medius *e* hat *a* unter- und *b* über sich: Sonus supremus hat *c* als partem triadis unter- und *d* über sich, woraus denn unsere Klang Folge des **Modi masculini** oder *perfecti* entsteht, nemlich *c, d, e, f, g, a, b, c*."

to the examination of which the whole first section of his work is devoted :—

- (1) The *triade harmonica perfecta* (major harmonic triad).
- (2) The *triade harmonica minus perfecta* (minor harmonic triad).
- (3) The *triade deficiente* (diminished triad).
- (4) The *triade superflua* (augmented triad).
- (5) The *triade manca* (defective triad as $d\sharp-f-a$, or $b-d\sharp-f$).

The *major harmonic triad* Sorge considers, like Rameau, to be derived from the senary division of the monochord, as well as from the resonance of sounding bodies, as the viola, cello, trumpet, horn, organ pipes, etc. The numbers 1, 2, 3, 4, 5, 6, 8, “form a band which links the consonances together.”

The *minor harmonic triad* cannot be represented by smaller numbers than 10 : 12 : 15. The minor triad then is not so perfect as the major : for the proportions 4 : 5 : 6, which represent the major triad, are much nearer to Unity than 10 : 12 : 15. “The trumpet gives this triad perfectly pure, at the sounds *e-g-b*.” (*Vorgemach der Mus. Komp.*, Ch. 7.)

The *diminished triad* is, strangely enough, treated by Sorge as *quasi-consonant* (!) and he justifies his introduction of it as an independent harmony (*Hauptaccord*) by a reference to the *Kleine General-bass Schule* of Mattheson, who says of this chord that “it has all the characteristics of a consonance” ! The trumpet gives the diminished triad $e-g-b\flat = 5 : 6 : 7$. But this 7 is “too flat.” The real proportions are 45 : 54 : 64. (*Ibid.*, Ch. 8.)

The *augmented triad* is found only in the Minor Mode ; while the “*triade manca*” represents the “fundamental” position of the chord of the Augmented Sixth. Sorge, then, discovers a triad, which is either major, minor, diminished, or augmented, on every degree of the major and minor scales :—

	Major.	Minor.	Diminished.
Major scale.			
Minor scale.			
	Minor.	Major.	Diminished. Augmented.

In the following sections of his work he treats of the *inversions* of these triads; and disagrees with Heinichen, who says that the \sharp chord is dissonant. "No consonant chord," he remarks, "can become, by inversion, a dissonant chord." (*Vorgemach der Mus. Komp.*, Ch. 4, Sect. II.)

In treating of dissonant chords, Sorge devotes a chapter to the question, "Which is the first dissonance?" (*Untersuchung welches die erste Dissonantz sei*). He answers that Nature points the way here: for the "natural Seventh" can be clearly distinguished in the resonance of the trumpet, horn, 16 and 32 feet organ pipes, the marine trumpet, etc. Although this minor Seventh, which has the proportion 4:7, is a little too flat, this is merely a proof of the necessity for temperament. In any case, Nature clearly shows that the minor Seventh is the first dissonance. "Nature," comments Sorge, "is the best guide in all Arts and Sciences"; it must therefore have appeared all the more strange to him that Nature should have made the minor Seventh "a little too flat."

We have therefore five different kinds of Seventh chords, obtained by adding a minor Seventh above each of the five triads already treated of. But other chords of the Seventh may be obtained by adding a *major* Seventh above the major triad (as *c-e-g-b*), above the minor triad (*a-c-e-g \sharp*) and above the augmented triad (*c-e-g \sharp -b*). Sorge does not say whether or not he has heard this major Seventh in the resonance of strings or organ pipes; or whether he derives it from the natural sounds of the trumpet.

He distinguishes two chords of the Ninth. One is the chord of the minor Ninth on the Dominant of the Minor Mode; the other is the chord of the major Ninth on the Dominant of the Major Mode. The first chord is really the complete form of the chord of the Diminished Seventh. "It cannot be asserted," he remarks, "of this diminished Seventh chord, that it is based on the diminished triad. It has as its real foundation the major triad, on which there is built up the chord *e-g \sharp -b-d-f*, by the addition of a minor Seventh and a minor Ninth. If now *e* as the fundamental note (*Grundklang*) be taken away, there remains the chord of the Diminished Seventh" (p. 346). Such, it will be remembered, was the explanation of this chord given by Rameau, in the *Génération Harmonique*.

Several of these dissonant chords may be taken without preparation, namely, the chord of the Dominant Seventh, and the Dominant major and minor chords of the Ninth; also, the chord of the Seventh on the leading note of the Major Mode, $b-d-f-a$, and the chord of the Seventh based on the "defective" triad $d\sharp-f-a-c$, or $b-d\sharp-f-a$. All other dissonant chords owe their origin to the mechanism of *Suspension* (*gebundene Septimen-accorden*), or arise from *passing-notes* (*in Transitu*).

Sorge makes the noteworthy statement that all chords of the Seventh, including those chords with the "natural" Seventh, really owe their origin to a simple passing-note, of the form 8-7. "The real foundation of all these chords is the passing Seventh (*durchgehende Septime*), for instead of $C-\overset{7}{G}-C-G$, we may substitute $C-\overset{8}{G}-C-G$ " (p. 362). Here Sorge presents us with a new theory of the origin of dissonant chords. If he means, as apparently he does, that the chord of the Seventh has an accidental, that is, a non-harmonic origin, he does not observe that he contradicts what he has already said with regard to the *natural* origin of the minor Seventh.

Although Sorge does not appear to have been wholly unacquainted with Rameau's theories, he does not treat of the Fundamental Bass, nor of "Chords by Supposition." He quotes a certain chord of the Eleventh from a work by *Telemann*, namely— $g-b-d'-f'-a'-c$ ", of which he characteristically remarks:—"Telemann here presents to us a sort of harmonic tower (*Thurm*), above which, like a star, we find the Eleventh, c ." Nor does he trouble himself greatly as to the origin of the Minor Mode. As in the Major Mode, the essential notes are those of the Tonic chord. The two modes are related because of the large number of sounds they possess in common. The Major Mode, he remarks, might say to the Minor: "Thou art bone of my bone, and flesh of my flesh":—which recalls Tartini's explanation of the minor harmony, and the Minor Mode, as the "necessary consequence" of the major.

CHORD OF THE DOMINANT SEVENTH.

That Sorge regards the chord of the Dominant Seventh as an "essential discord," that he derives it from the natural sounds of the trumpet, and that he allows it to be taken without preparation, is considered by Fétis to be an event of epoch-making importance for the theory of harmony. He remarks:—"Let this point be carefully noted, for here we have arrived at one of the most important facts in the history of harmony: it is the *second epoch* of the genuine discoveries which have been made in this science, and the glory of this discovery belongs to the humble organist of Lobenstein, ignored by all musical historians up to this day. *For the first time*, he has established the fact that there is a dissonant chord which exists by itself, apart from any modification of another harmony, and he states that this chord is absolutely different from other dissonant harmonies. . . . Even if Sorge has been led astray by the semblance of regularity presented by the different chords of the Seventh, he has nevertheless grasped the fundamental character of the chord of the Dominant Seventh, and of modern tonality. In this, he deserves to take rank in the history of harmonic science immediately after Rameau, who has first perceived the foundations of this science, and established them in his theory of the inversion of chords."¹

Fétis, at least, deserves credit for drawing attention to the merits of the "Vorgemach," which is in reality an important theoretical work. Fétis however is wrong in his facts. Sorge is not the first who has said that the chord of the Dominant Seventh may be taken without preparation. Rameau, in more than one of his works, permits this not only in respect of the chord of the Dominant Seventh, but of *any Dominant discord*. Again Sorge makes use of the "natural Seventh" not only for the major, but for the minor and even the diminished triad, as *b-d-f-a*, and *d-f-a-c*. Fétis considers the theoretical importance which he—not wholly without reason—attaches to the chord of the Dominant Seventh to consist in the fact that it is the sole "natural" *dissonant* chord, and that, being dissonant, and its resolution on the Tonic harmony being its most natural resolution, it

¹ *Esquisse de l'histoire de l'harmonie.*

thus determines our modern tonality. There is no doubt at least that the distinguishing characteristic of the Dominant Seventh chord, especially as compared with the Tonic chord, on which it "resolves," is exactly its quality of dissonance. Sorge, however, thinks that the "natural chord of the Seventh" should be regarded as the first or principal of all the dissonant chords, *because it sounds almost as well as a consonance*. He calls it an "almost consonant dissonance," and imagines that the good effect which this chord produces on his ear is a sufficient explanation of its theoretical importance.¹

In this respect Sorge shows much less sagacity than Rameau. Rameau refused to consider the chord of the Dominant Seventh as being derived from the natural seventh harmonic sound; and further says that if the Third he adds above the Dominant harmony in order to form this chord is not of the correct proportion, this defect of proportion, at any rate, accentuates the dissonant character of the chord. Compared with the theory of Rameau, Sorge's generation of the chord of the Dominant Seventh represents not an advance, but a retrograde step. For here begins the theory of "essential" and "natural discords." If, as Fétis thinks, Sorge's theory of the "natural chord of the Seventh" is an epoch-making event, it is principally so only in this sense, that it has led to some extraordinary results in the theory of harmony.

F. W. MARPURG.

Sorge found in *Friedrich Wilhelm Marburg* (1718-1795) a determined, and, owing to the enormous influence he wielded in Germany and outside of it as a writer and critic, a formidable opponent of his theory. The influence of Rameau had extended to Germany, and the theories of the now famous French musician did not fail to excite the attention of Marburg. In 1757 Marburg published *Systematische Einleitung in die musikalische Setzkunst nach den Lehrsätzen des Herrn Rameau*, which was mainly a translation

¹ "Dieser Septenarius aber vereinigt sich mit denen vorhergehenden Zahlen 1, 2, 3, 4, 5, 6, und verursacht keine widrige Tremores [beats?] wie wohl andere Dissonantzen thun: weswegen diese fast consonirende Dissonantz vor die aller leidlichste passiret," (*Vorgemach der Mus. Komp.*, p. 341.)

of d'Alembert's *Eléments de Musique*; and in 1755-58 his *Handbuch bei dem Generalbasse und der Composition*, in which he proclaimed himself to be a follower of Rameau. It was against the faults contained in this latter work that Sorge directed his criticisms in his *Compendium Harmonicum, oder kurzer Begriff der Lehre von der Harmonie* (1760). Marpurg replied in the same year with *Herrn Georg Andreas Sorgen's Anleitung zum Generalbass*, etc., and continued his attacks in his *Kritische Beiträge zur Musik*.¹ In these long, acrimonious, frequently amusing, but always informative discussions, Marpurg makes his theoretical position even more clear than in his *Handbuch*. "I have taken the liberty," he remarks, "of making known, not only in Germany, but still further afield, the system of Rameau. . . . As every one was now able to compare Sorge's system with that of Rameau, Herr Sorge was clever enough to see that the comparison was not to his advantage." Hence his attacks on "Herr Rameau and myself, his unworthy disciple."

Marpurg, however, considered that Rameau's system was defective in many respects. A complete system, he remarks, must comprise all possible tones, intervals, and chords, in so far as these are not contradicted in practice. "They must be of such a character as to conform to the demands of practice, as well as of pure speculation. Such a [complete] system is based on the scale of one and twenty sounds, these lying between its two "*termini*" (the Octave): (such a scale Marpurg considers to be derived from the constituent sounds of a central key, and its five most closely related keys) and the different chords of two, three, or more notes compounded of these tones furnish all possible intervals and chords."² This extraordinary pronouncement shows how little Marpurg appears to have really grasped and understood the principles of Rameau. Rameau insists everywhere in his works that it is harmony which produces the scale, and not the scale, harmony. Marpurg imagines that he adheres to this principle, even if he develops it a little, when he says:—"The intervals arise, like the tones, ascending and descending, by collecting together the sounding and co-vibrating Fifths [and Thirds] of the fundamental notes (*c-e-g*). One compares with

¹ Vol. V. ("Untersuchung der Sorgischen Lehre von der Entstehung der dissonirenden Sätze").

² *Krit. Beiträge*, Sect. I.

the harmony *c-e-g* the sounding Fifth *g-b-d*, and afterwards the co-vibrating Fifth *f-a-c*. One takes again the sounds *g-b-d*, and *f-a-c* [!] and finds in the same way *d-f#-a*, arising from the first, and *b-b-d-f*, arising from the second. These are first compared with *c-e-g*, *g-b-d*, and *f-a-c*, and then with one another. One proceeds in this way through the whole table of relationships (*die ganze verwandtschaftstabelle der Dreiklänge*) of the triads, and finds all the possible intervals."¹ Such then is the programme of "the combined Rameau-Marpurg system." Happily we are left only to imagine what Rameau would have thought and said of it.

After this revised and improved version of the manner in which the scale—the "chromatic-enharmonic scale," consisting of one and twenty notes,—is developed from harmony, Marpurg now proceeds to show us how harmony (and all kinds of possible chords, consonant and dissonant) is developed from the scale. He actually begins by asking the question—"How do we get chords in music?" "We have," he says, "now got tones and intervals. How do we get chords in music? In the same way as we get tones and intervals. By means of the connection of tones with one another we have obtained intervals: We must now connect the intervals with one another in order to obtain chords."² The importance to be attached to each interval as respects its harmonic significance, is decided by Marpurg in the following extraordinary fashion:—"The quality of an interval is determined according as its ratio approximates to, or is remote from, Unity. Such a distinction, however, is of value only in theory, in the science of temperament; but not in practice, in which the rank of an interval is decided through the frequency of its species. We must therefore investigate how often each interval occurs [that is, in the scale of 21 notes], and if we find that the Augmented Second occurs more frequently than the Diminished Third, we must conclude that the former is more necessary than the latter [!], and if we find that two intervals of different species occur the same number of times, this is a sign that both are of equal rank in practice. . . ." "I shall here briefly indicate how often each kind of interval appears in the complete scale of 21 degrees, which we make use of for the 12 major and 12 minor keys."

¹ *Krit. Beiträge*, Sect. II. "The Combined Rameau-Marpurg System."

² *Ibid.*

DEVELOPMENT OF THE ADDED-THIRD THEORY OF
CHORD-GENERATION.

Marpurg then finds that among the intervals of all sorts, —perfect, major, minor, diminished, and augmented,—which he enumerates, the major Third occurs only 17 times, while the minor Third occurs 18 times. He will not, however, abide by his own conclusions. “That the minor Third occurs oftener than the major Third, is not in the least derogatory to the superiority of the major triad as it is established by Nature” [!].

The species of interval of which several ought to be compounded together in order to form chords is, according to Marpurg, the *Third*. “Let us now go back to the two triads given to us by Nature [major and minor harmonies] and consider their outward form. We find that, apart from the difference of the Thirds, each consists of a Third and a Fifth. A Third and a Fifth above a fundamental note means that we have a chord arranged in Thirds. How, then, ought the intervals to be connected with one another? By means of Thirds.” In this way, “by means of the imitation of Nature, we discover many varieties of chords built up by means of Thirds.”¹

Marpurg's ideas concerning the operations of Nature in the domain of harmony are further manifested in his explanation of what he calls “fantastic” or mixed triads, as $b-d\sharp-f$, $d\sharp-f-a$, etc. “It is a question,” he remarks, “which of these mixed triads, namely $b-d\sharp-f$, and $e-g\sharp-b\flat$, likewise $d\sharp-f-a$ and $g\sharp-b\flat-d$, ought to have the preference, seeing that they occur in the diatonic-chromatic scale an equal number of times. This question cannot be determined until we have decided what is the origin of the fundamental sounds obtained from the progression founded on fifths. Now, as the fundamental sounds b and e exist in Nature sooner than the fundamental sounds $d\sharp$ and $g\sharp$, so, quite naturally, the major diminished triad [$b-d\sharp-f$] ought to be preferred to the doubly diminished triad” [$d\sharp-f-a$].²

Such is Marpurg's idea of a theory of harmony which “conformed to the demands of practice”; and it is an

¹ *Krit. Beiträge*, Sect. II.

² *Ibid.*

undoubted fact that there were many, even in this country, who considered that Marpurg, as a "practical theorist," was far in advance of Rameau.

In his *Handbuch bei dem Generalbass*, Marpurg distinguishes the following fundamental chords, which he divides into two classes. The fundamental chords of the first order comprise the different species of triad, and the various kinds of chords of the Seventh. (By a fundamental chord Marpurg understands all non-inverted chords, that is, all chords arranged in Thirds). "There are not more than three fundamental chords of the first order, namely :—

- (1) The Consonant harmonic triad. (Major or Minor as *c-e-g*, or *a-c-e*.)
- (2) The Dissonant harmonic triad. (Diminished or Augmented as, *b-d-f*, or *c-e-g#*.)
- (3) The Chord of the Seventh, consisting of 3rd, 5th and 7th (as *g-b-d-f*, *c-e-g-b*, etc.). The triads arise by means of the addition of intervals; thus the triad consists of two 3rds added together: the chord of the Seventh of three 3rds."

By fundamental chords of the second order, Marpurg understands "*chords by supposition.*" These are :—

- (1) The Chord of the *Ninth*, obtained by placing a note a 3rd below the fundamental sound of a chord of the Seventh, as *E—g#-b-d-f*.
- (2) The Chord of the *Eleventh*, obtained by placing a note a 5th below, as *C—g#-b-d-f*.
- (3) The Chord of the *Thirteenth*, obtained by placing a note a 7th below, as *A—g#-b-d-f*.

Marpurg, of course, does not confine himself to the single chord *g#-b-d-f*, in order to form "*chords by supposition,*" but makes use of other chords of the Seventh for this purpose, as *b-d-f-a*, *f-a-c-e*, *d-f-a-c*, etc.

Of several other varieties of chords investigated by Marpurg, mention may be made of what he calls the "*mixed dissonant harmonic triad.*" Although Marpurg tells us that "the dissonant triad owes its origin to an *alteration* of the

3rd or 5th.”¹—which is not in accordance with his theory of the generation of chords by means of the compounding of intervals selected from the chromatic-enharmonic scale of twenty-one notes; nor an explanation of the diminished triad on the leading note—he nevertheless explains the mixed dissonant triad as one which belongs to two keys. “Thus, in key C, the other notes of the most nearly related scales G, F, etc., may enter, so as to form the chromatic scale *c-c#-d-d#-etc.* . . . If I may for a moment be permitted to glance into the hidden depths of Nature [an allusion to *Sorge*], there exist the following mixed triads”:—²

- (1) The “hard Diminished Triad,” *b-d#-f*, mostly used in $\frac{6}{4}$ position (*f-b-d#*). With the 7th added (*b-d#-f-a*) we obtain the chord $\frac{4}{3}$ (French 6th *f-a-b-d#*).
- (2) The “doubly Diminished Triad,” as *d#-f-a*. The chord of the Augmented 6th (*f-a-d#*) is derived from this triad. With the diminished 7th added above the triad, we obtain the chord of the Augmented $\frac{6}{5}$ (German 6th *f-a-c-d#*).
- (3) The Triad arising from the Augmented 3rd and pure Fifth, as *b-b-d#-f* (!)
- (4) The Triad formed from the Augmented 3rd and Augmented 5th, as *b-b-d#-f#* (!)

Marpurg goes on to describe several other “chords” belonging to this class, but perhaps the above are here sufficient.

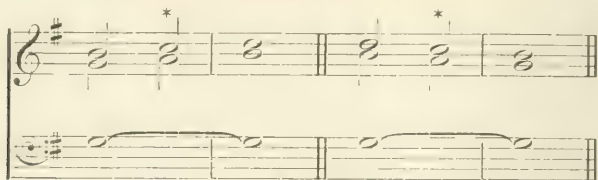
It is important to note the development which the theory of “chords by supposition” undergoes at the hands of Marpurg. The chord of the Ninth presents in its formation an unbroken series of Thirds; not so the chords of the Eleventh and Thirteenth. Marpurg, however, exerts himself to remedy this defect. “In the chord of the Eleventh,” he says, “we must remember that between the fundamental note and the 5th below [as C—*g-b-d-f*] a *third* must be inserted, [as C—*e-g-b-d-f*] in order that the chord may be properly understood. This six-part chord, however, is of little use in its complete state.”³ Of the use of this chord in three-part

¹ *Handbuch*, p. 48.

² *Ibid.*, p. 43.

³ *Ibid.*, pp. 74, 75.

writing, Marpurg gives this example :—



in which he discovers a chord of the Eleventh at * : whereas, in reality, there is nothing more serious than one or two innocent passing-notes.

Of the chord of the Thirteenth, he remarks :—" The chord of the 13th arises when, to a chord of the 7th, a 7th is added below, as A—*g#-b-d-f*. It must be remembered that between the fundamental note [*g#*] and the 7th [*A*], *two Thirds must be supposed*, in order that the chord may be properly understood. The chord in its complete form, A—*c#-e-g#-b-d-f*, *cannot be used* ! So then Marpurg, having obtained his Thirds, finds himself obliged to take them away again. Otherwise, one might say, the chord cannot be " properly understood." It is especially to the " combined Rameau-Marpurg system " that we owe the " chords " of the " Ninth," " Eleventh," and " Thirteenth."

CHORD OF THE DIMINISHED SEVENTH.

It is impossible to avoid referring to Sorge's criticism of Marpurg's theory of the chord of the Ninth : for there is little doubt that Marpurg's new development of the Rameau theory of " chords by supposition " was accelerated by the criticism to which he was subjected by Sorge. The passage of arms between the two theorists—for Marpurg was not slow to reply—is amusing as well as instructive. In the tenth chapter of his *Compendium harmonicum* Sorge asks the question—How does the chord of the Ninth arise ? —and remarks :—" Is it by means of a Third crawling under the chord of the 7th, according to the teaching of Rameau and Marpurg ? By no means ! That would be a bad foundation for the free, as well as the suspended Ninth.

The free unsuspended Ninth rises above the chord of the Dominant Seventh and ornaments, like a beautiful gilded dome, the harmonic edifice. Its foundation is the chord of the Seventh, a sure foundation. No use is made of supposition, or composition (Marpurg had thrown out the suggestion in his *Handbuch* that the chord of the Ninth $c-g\sharp-b-d-f$, was compounded of the two chords of the Seventh $c-g\sharp-b-d$ and $g\sharp-b-d-f$) for to make use of 'supposition' is as if one were first to build his house in the air, and then proceed to lay the foundation of it! This is what is done by Rameau and Marpurg. This chord of the Ninth is the real foundation of the chord of the Diminished Seventh $g\sharp-b-d-f$, and of the minor chord of the Seventh $b-d-f-a$, or $f\sharp-a-c-c$ (this is a development of Sorge's theory; in the *Vorgemach* he explains the chord $b-d-f-a$, as a chord of the Seventh based on the diminished triad $b-d-f$), and of all the chords arising therefrom by inversion; hence all these chords, and their inversions, can be taken without preparation. Only it has to be noted that frequently the true fundamental note yields up its authority in favour of the Third of the chord." That is, Sorge permits the fundamental note of the chord $c-g\sharp-b-d-f$ to be omitted, and the chord to assume the form $g\sharp-b-d-f$, a chord of the Diminished Seventh.

Sorge's insight into the real nature of the chords of which he treats is evident. Unfortunately, his concluding sentence presented a weak point which was immediately perceived by Marpurg. In his *Kritische Beiträge* Marpurg replies: "My dear Herr Sorge, what happens when your true foundation of the chord of the 9th 'yields up its authority in favour of the 3rd'? Does it not remind you of a house from which the foundation has been taken away, and which is left to swing in the air? Will it not then fall to pieces? Only, this is your affair, not mine; and I must allow you to prop up your house in the best way you can. But chords are not houses. A chord may be placed on its head [inverted]; and one may remove one or more sounds from a chord, but it would be impossible to remove a story from a house."¹ Here Sorge finds himself caught.

Marpurg, then, considers $g\sharp-b-d-f$ to be a fundamental

¹ *Krit. Beiträge*, Sect. VI.

chord, with fundamental note $g\sharp$, which is absurd. Sorge also considers it to be a fundamental chord, but with fundamental note e , which is omitted. If the chord be regarded as a chord of the Ninth, Sorge's view of the matter is the more reasonable. There are theorists, however, who hold that the chord $g\sharp-b-d-f$ represents the *first inversion* of the chord of the minor Ninth. This is a new theory of inversion, and one by no means contemplated by Rameau, who held, quite rightly, that it was the *Octave* which made inversion possible, and that no chord could be inverted which exceeded the compass of an Octave. The omission of a note from a chord does not bring about the inversion of the chord. But again, if the chord $g\sharp-b-d-f$ represents a chord of the Ninth in fundamental position, what is the first inversion of the chord?

It is extremely doubtful if Marpurg really understood the theoretical principles of Rameau, whom he professed to follow. The "combined Rameau-Marpurg system" is, at any rate, a monstrous distortion of these principles. And yet Marpurg was a man of wide erudition, of great and undoubted talent, not only as a writer and critic on musical subjects, but in many respects as a theorist also. His influence as a theorist was far-reaching—his *Handbuch* was translated into at least two other languages—and there is little doubt that it extended to this country. This can only be regretted; for it did not tend to the advancement of the science or practice of harmony.

PART III.

CHAPTER XI.

OTHER THEORISTS OF THE END OF THE EIGHTEENTH AND
BEGINNING OF THE NINETEENTH CENTURIES—KIRN-
BERGER, FÉTIS, ETC.

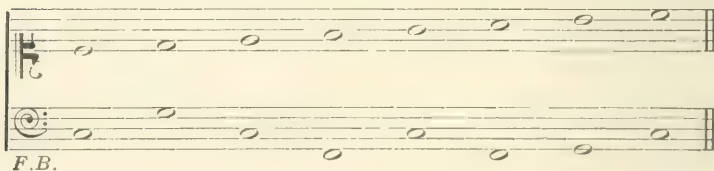
J. P. KIRNBERGER.

ACCORDING to Dr. Riemann (*Geschichte der Musiktheorie*, p. 476, *et seq.*), it is not Marpurg we have to thank for the wide dissemination of the theory which considers all possible chords to be formed from a series of Thirds added together, but *Joh. Phil. Kirnberger* (1721-1783). This is a curious opinion; for the distinguishing feature of Kirnberger's works, and that which marks them out from almost all similar works of his own time, and of later times, is that no attempt is made to formulate any theory of chord generation, whether by means of acoustical phenomena, or by adding Thirds to one another. Kirnberger rejects all chords of the "Ninth," "Eleventh," and "Thirteenth," and recognizes as "real" harmonic combinations nothing but the simple triad and chord of the Seventh. In his principal theoretical work *Die Kunst des reinen Satzes in der Musik*, published 1774-79, he simply states (p. 26) of the consonant triad that it consists of a fundamental note (*Grundton*), a Third, and a Fifth; to which there may be added the Octave; while the chord of the Seventh consists of a Third, a Fifth, and a Seventh; or, more accurately, of a Seventh (not a Third!) added above the triad (p. 60).

Kirnberger's works, indeed, represent a reaction against the inconsequences of the Rameau-Marpurg system, and an attempt to bring back harmonic theory to the paths of sanity and commonsense. It would appear that the work *Die wahren Grundsätze zum Gebrauch der Harmonie* (1773) was written expressly with this object. In the *Preface* to

this work Kirnberger remarks :—" Rameau has filled this theory [of harmony] with so many absurdities as to cause one fairly to wonder how such extravagances could ever have found acceptance among us Germans. . . . Those who are acquainted with Rameau's theory will, in the course of this work, soon perceive in what respects his theory and my own differ from each other, and which it is that explains most simply and most naturally the origin and treatment of chords." It was less against Rameau, however, than against Marpurg that Kirnberger's criticism was most probably directed.

But although Kirnberger ostensibly rejects Rameau's principles, nevertheless several of the theoretical considerations he brings forward differ in little or nothing from those advanced by the French theorist ; and here indeed Kirnberger more faithfully represents the teaching of Rameau than does Marpurg. For example, in *Die Kunst des reinen Satzes*, Part II., he gives this as the first and most simple method of harmonizing the major scale (*die erste und einfachste Art des harmonischen Basses*) :—



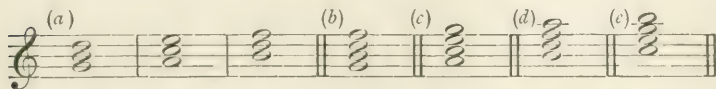
He distinguishes, also, the ascending leading-note (Rameau's "major dissonance") from the descending one ("minor dissonance"). Both the seventh and the fourth degrees of the scale, Kirnberger states, are leading-notes ; but they are not of the same character. "The leading-note, which is the third of the Dominant chord, produces the *greatest unrest in the hearer* if the following chord [Tonic chord] be omitted, even when *no dissonant interval forms part of the Dominant triad.*"¹ The leading-note on the fourth degree of the scale "is of quite a different character ; when it forms a part of the harmony of the Dominant, it appears as

¹ *Grundsätze des Generalbass*, Sect. II., p. 43.

a real or essential (*wesentliche*) dissonance" (p. 43). In the case of this note, then, it appears that it is dissonance to which it owes its leading quality, whereas the first leading-note retains its leading quality whether it forms part of a dissonant chord or not. As for the cause of the dissonant or leading effect of the seventh degree of the scale, Kirnberger says further:—"Every interval smaller than a minor Third is a dissonance; as now, *b* is only a minor Second from *c*, then the two sounds must be dissonant with one another."¹ Evidently this explanation is not complete. Otherwise, *f*, the fourth degree of the scale, which is only a minor Second from *e*, ought to have as pronounced a leading quality as *b*. This, however, is not the case. Further, Kirnberger does not investigate the circumstances under which both the fourth and seventh degrees of the scale may produce the effect, not of unrest, but its opposite, rest, as in the Tonic-Subdominant and Tonic-Dominant Cadences.

Kirnberger, then, distinguishes (*a*) the ascending leading-note; (*b*) the descending leading-note; and (*c*) both leading-notes combined.² These remarks of Kirnberger cannot have been without influence on Fétis and his theory of "Tonality."

Like Rameau, also, Kirnberger knows only two chords—the triad, and the chord of the Seventh. "The whole of harmony," he remarks, "consists of two chords only, in which all other chords have their origin."³ "These are:— (1) The consonant triad, which may be Major, Minor or *Diminished* [*f*] (*a*). (2) The dissonant, "essential" chord of the Seventh, which is of four kinds: consisting either of a minor 7th with perfect 5th and major or minor 3rd (*b* : *c*), or, with diminished 5th and minor 3rd (*d*), or of major 7th with perfect 5th and major 3rd (*e*)":—



Kirnberger therefore places a triad, as well as a chord of the Seventh, on each degree of the major scale. All these

¹ *Grundsätze des Generalbass*, Sect. II., p. 43.

² *Ibid.*

³ *Die wahren Grundsätze zum Gebrauch der Harmonie.*

chords of the Seventh he describes as "essential." All however are not equally perfect. "Of these ground-chords the first, that is the major triad, is the most perfect; the diminished triad on the contrary is the most imperfect *consonant* ground chord. The chord of the minor 7th with perfect 5th and major Third (chord of the Dominant Seventh) is most perfect, and the chord of the major 7th the most imperfect dissonant ground chord." It is noteworthy that Kirnberger regards the perfection or imperfection of the chords of the Seventh as determined by their nearness to, or remoteness from, the Tonic harmony.

He says:—"The proof of this is as follows. The first chord of the 7th [*g-b-d-f*] is the most perfect, because it leads directly to the Tonic chord. . . . and brings about a complete

close, $\begin{matrix} G & - & C. \\ 7 \end{matrix}$ The second chord of the 7th [*a-c-e-g*] is less perfect, because it does not lead immediately to the Tonic triad, but must first proceed to its Dominant, that is A — D — G.

$\begin{matrix} 7 & 7 \\ & \# \end{matrix}$ The third chord (*b-d-f-a*) leads to a *Minor*

B — E — A

Cadence: $\begin{matrix} 7 & 7 \\ & \# \end{matrix}$ The fourth chord [*c-e-g-b*] is less adapted

than any of the others to bring about a state of rest, C — F# — B — E,

$\begin{matrix} 7 & 7 & 7 \\ & & \# \end{matrix}$ and is the most imperfect of all."

In the resolutions of these discords, Kirnberger exhibits a curious compliance with the requirements of the Fundamental Bass of Rameau; for he might quite correctly have given other resolutions to some of these chords of the Seventh. Besides, in the case of the last three chords, they do not reach the Tonic chord of C at all, nor can they be regarded even as belonging to this key. Thus the second chord $\begin{matrix} A \\ 7 \end{matrix}$ and the third $\begin{matrix} B \\ 7 \end{matrix}$ are Rameau's Subdominant Discords (3rd added below Subdominant harmony) in the keys of G major, and A minor respectively; while the fourth chord $\begin{matrix} C \\ 7 \end{matrix}$ is in the key of E minor.]

All these chords of the Seventh Kirnberger describes as *real* or *essential* (*wesentliche*) dissonances. All other dissonant combinations are *accidental* (*zufällige*) or non-essential; more strictly, all other dissonant chords arise by means of the retardation of the real or essential harmonic notes of the chord, which retardations *take the place* of the real harmony notes. Such are the notes marked * in the following illustration:—



Such an “unreal” dissonant note “is most dissonant against that note in the place of which it stands, and it finds its complete resolution in the ground chord itself. The essential dissonance [the Seventh] on the contrary, is *not dissonant because it takes the place of a consonance*, but because, being added to the consonant intervals [of the triad], it destroys the consonant harmony of the triad, or at least renders it very imperfect. Therefore it cannot resolve on the same bass note, for it does not represent another tone belonging to the harmony of this note, but makes absolutely necessary the succession of another harmony for its resolution.”¹ This statement represents a notable achievement in the science of harmony, and brings to light a principle which the practice of composers, and the course of harmonic development since Kirnberger’s time, have made increasingly important.

Both kinds of dissonance may occur in a single chord, for example, *g#-b-d-f*; in this chord, Kirnberger regards the note *f* as a non-essential or unreal dissonance; while *d* is the essential dissonance, being the Seventh of the chord of the Dominant Seventh *e-g#-b-d*. All this may be clearly perceived in the resolution of the chord; *f* first falls to *e*, the harmony note whose place it occupies; in doing so it merely resolves on its own ground-chord *e-g#-b*. The note *d*, however, cannot resolve thus: for this, a change of harmony is

¹ *Die wahren Grundsätze*, etc., Sect. VI.

necessary. Although the distinction Kirnberger makes here is a real one, it is doubtful whether, in making use of the term "essential" to distinguish the dissonant chord of the Seventh from other dissonant combinations, Kirnberger exactly described the nature of the chord of the Seventh. For at bottom the dissonance of the Seventh is not more "essential" than any other dissonance. It is evident that Kirnberger is by no means prepared to concede that the only really essential chords in music, that is, the only chords which in themselves possess harmonic significance, are the major and minor harmonies. We have seen that he considers the diminished triad (*b-d-f*) to be a consonant chord.

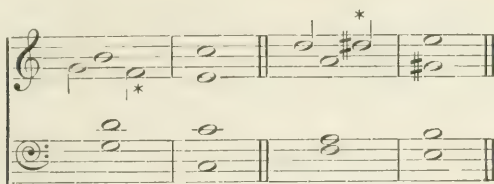
Kirnberger would therefore appear, almost in spite of himself, to have given a considerable impetus to the theory of the "essential discord," of which so much has been made in this country. But in our own day this term has come to mean almost exactly the opposite of what Kirnberger intended. Thus the following are said to be "essential discords"; whereas, according to Kirnberger's teaching, they are "accidental" or "non-essential" discords:—



Like Sorge, Kirnberger sees in the "passing Seventh," that is, in the Seventh taken as a passing-note (which frequently occurs in compositions by the Church composers even before the time of Palestrina) the real origin of the chord of the Seventh.¹ Noteworthy also is his explanation of the chord of the Augmented Sixth. "The augmented Sixth," he remarks, "*is purely a melodic ornamentation carried over into harmony*, and, as it takes the place of the major Sixth . . . it neither brings about a change in the ground harmony, nor, still less, does it form in itself a distinct ground chord, as

¹ *Die Kunst des reinen Satzes*, Part I., p. 30.

some have wrongly taught.”¹ The explanation of these two chords, then, is as follows:—



One has little difficulty in agreeing with Kirnberger that the chord of the Augmented Sixth cannot be regarded as a “ground chord,” nor in recognizing the importance for the theory of harmony of his explanation of the origin of these chords. At the same time, Kirnberger goes too far and too fast if he considers, as he appears to do, that the *f* in the first chord and *d#* in the second have a purely melodic but no harmonic significance. His attitude in respect of these chords is not consistent. For although the origin of both dissonances is the same, he considers the Dominant Seventh as an “essential” dissonance, but the Augmented Sixth as non-essential.

Kirnberger also distinguishes two forms of the $\frac{6}{4}$ chord, which represents the second inversion of the major or minor harmony. Heinichen and Mattheson had considered it to be a dissonant chord. Rameau denied this to be the case, seeing that it represented a consonant harmony; while writers of this time, even Sorge, generally devoted considerable space in their works to the discussion of the question as to whether the Fourth was a consonance or a dissonance. Kirnberger recognizes a consonant form of the $\frac{6}{4}$ chord, which represents a consonant harmony, but also a dissonant form, in which the 4th and 6th retard the 3rd and 5th. Here again, Kirnberger manifests his admirably clear perception of harmonic and tonal relationships.

So then, our author concludes, the whole edifice of harmony is built up from two simple ground chords—the triad and the chord of the Seventh. Only by such principles as he has laid

¹ *Die wahren Grundsätze*, etc., Sect. XV.

down can the difficulties of harmony be solved and made intelligible :—" On the other hand, all music which cannot be traced back according to these fundamental principles to a natural succession of the two ground chords is incomprehensible " (*unverständlich*).¹ This is a daring corollary ; but one nevertheless which deserves consideration. Further, he remarks, his theory of harmony is simpler and more true to the facts than that of Rameau. " Many have been persuaded by French writers that we have Rameau to thank for this simple theory of harmony. . . . But Rameau has not at all conceived in his theory the real simplicity and purity of harmony, as he actually sometimes regards passing-notes as fundamental notes, on which he bases his chord of the Added Sixth, which he considers to be a ground chord." ² Kirnberger considers the Sixth in this chord to be merely a passing-note.

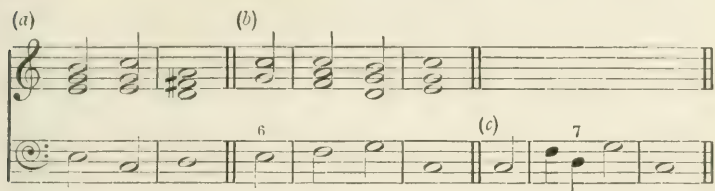
On the other hand, Rameau might have replied that Kirnberger not only accepts the scale without any attempt to explain it, but considers himself at liberty to place not only a triad but a chord of the Seventh on each degree of this scale, without appearing to observe that it is necessary to explain whence these chords are derived. Besides, they exist as isolated entities, and apparently without any harmonic connection between them. Nevertheless, this harmonic connection constitutes one of the chief problems of harmonic science, and the theory of harmony which makes no serious attempt to account for it is a superficial theory. Further, that Kirnberger makes harmony for the most part to depend on melody. That is, harmony is melodically determined. But Kirnberger is unable to formulate any fundamental principles of melody.

After Kirnberger's criticism of Rameau, it is curious to note his explanation of the ground or fundamental bass rising a Second. He says:—" It often appears that the ground bass proceeds by the step of a second, when in reality this is not the case. In the following passage (*a*) it appears that there are simply triads, and the bass of this passage appears to be the ground bass. . . . But the second chord carries here, in addition, the 6th [!] [no 6th is present in the chord in

¹ *Die wahren Grundsätze, etc.*, Sect. XXIII.

² *Ibid.*, Supplement.

question], and is therefore not a ground chord but a $\begin{smallmatrix} 6 \\ 5 \end{smallmatrix}$ chord" [!]:—¹



Also, Kirnberger tells us that the actual Fundamental Bass of the passage at (b) is to be understood as at (c). Here, then, we find Rameau's "double employment" in full operation! This, surely, is one of the most curious facts in the whole history of the theory of harmony. Kirnberger, the empiricist, who has explained Rameau's chord of the *Added Sixth* as arising simply from a passing-note, resuscitates Rameau's discredited theory of "double employment" in order to account for the immediate succession of both Dominants!

OTHER THEORISTS OF THE END OF THE EIGHTEENTH AND BEGINNING OF THE NINETEENTH CENTURIES.

By the end of the eighteenth century, the theory of Rameau had begun to lose ground, even in France. Thus N. E. Framéry, in referring to it (*Art. Accord* in his *Encyclopédie méthodique*, 1791), remarks:—"Rameau is the inventor of '*double employment*' which, after being long a subject of ridicule, has now become forgotten. To-day this chord [Added Sixth] is no longer regarded as a fundamental chord, at least in practice, and the best authors only make use of it as an inversion of the chord of the Seventh." It is not surprising that the influence of the Fundamental Bass began so soon to diminish. Musicians, who for the most part failed to grasp its real theoretical significance, had regarded it mainly as a guide to composition. But Rameau's directions for

¹ *Die wahren Grundsätze*, etc., Sect. XXII.

the use of the Fundamental Bass were, to say the least, ambiguous. He had never been able to give any adequate explanation of the secondary triads of the key, nor to say with certainty whether or not the ascent or descent of the Fundamental Bass by the interval of a Third brought about a modulation. It need not be wondered at, therefore, that the system of Rameau was soon forsaken for new "Practical schools of composition" which made light of the difficulties that had perplexed the great theorist, and saw no theoretical problems whatever in the way of the immediate succession of both Dominants, or of the "ground-bass" rising or falling a Third.

Further, the practice of composers, the new and strange chords they employed, the novelty of their harmonic successions, which appeared to outrage all the rules which Rameau had laid down for the use of the Fundamental Bass, bewildered even the few who still swore fidelity to it. Nevertheless, the influence of Rameau persisted in other directions, and chiefly along two main lines, namely, the derivation of the scale and of chords from the sounds of the harmonic series, and the formation of chords by means of superadded Thirds. As a rule both methods were combined. Only exceptionally does one meet also with systems in which there is a definite abandonment of Rameau's principles, especially his use of acoustical phenomena. Of such works on harmony, which appeared during the latter part of the eighteenth and beginning of the nineteenth centuries, there may be mentioned the following:—

P. J. ROUSSIER (Abbé)—*Traité des accords et de leur succession, selon le système de la basse fondamentale* (1764); *Observations sur différents points de l'harmonie* (1765).

In the *Preface* to the first work, Roussier explains that his desire has been to write not so much a theoretical as a "practical" work on harmony. "I have thought," he says, "that a treatise on chords, in which all theory was suppressed, and which really belonged to the art of Accompaniment and of Composition, would render the study of harmony less protracted, and especially less repulsive." While, then, he follows in his work the system of Rameau, he nevertheless thinks it necessary to develop it a little.

"It is sufficient that in several chords . . . the grave sound is in reality the physical generator of the principal

sounds, in order to call fundamental, by extending somewhat the meaning of this term, and by a sort of analogy, every other direct chord, although its musical harmonics (*harmoniques*) are not always in the same proportion nor of the same kind, as the real harmonics of the grave sound of the chord [!]. But is it desirable that Nature should leave Art nothing to do? ”¹

Roussier distinguishes, like Rameau, a major and a minor dissonance. “Every 7th should resolve in descending a degree: every 6th [added 6th] should ascend a degree.” He adds that before the discovery of the Fundamental Bass, there was great uncertainty as to the proper treatment of dissonant intervals, such as the tritone, the augmented Fifth, etc.: “in these intervals the upper note is a leading-note.”

Every note of the major or minor scale may bear a chord of the Seventh. “The intervals in these chords are selected from the notes of the scale, or mode, in which they occur.” (It is, then, the scale which determines harmony.)

“Chords may be derived from other fundamental chords in four different ways:—(1) by Inversion; (2) by Supposition; (3) by Substitution; (4) by Substitution and Supposition combined. The only chord derived by this last method is the chord of the Diminished Seventh.” A chord distinguished by Roussier is *b-d#-f-a*, which he calls a “Mixed Dominant” chord (*Dominant Mixte*). “This chord is neither a Tonic Dominant, nor a Simple Dominant, but shares the features of both. It is analogous to the Tonic-Dominant by reason of its major 3rd, and to the Simple-Dominant by reason of its diminished Fifth [!].” The fundamental note of this chord is *b*, and its inversions are *d#-f-a-b*, *f-a-b-d#*, etc. !

In Part III. of his work (“*In which some new chords are proposed*”), Roussier proceeds to explain some “new chords.” It will be found, he remarks, that some of these chords are less hard in effect than the chord of the Augmented Sixth. One of the “new chords” is *d#-f-a-c*. “This chord is fundamental: the diminished Fifth *d#-a* is its original minor dissonance.”² Inversions of this “fundamental chord are, *f-a-c-d#*, *a-c-d#-f*, and *c-d#-f-a*. Other new chords are *g#-d#-f-a-c*: *g-d#-f-a-c*: *c-d#-f-a-c*, etc. These are chords by supposition: *d#* is the fundamental note of all three.

¹ *Traité*, p. 26.

² *Ibid.*, p. 160.

It cannot be said that, on the whole, Roussier's development of Rameau's system tended to improve it.

LEVENS (chapel-master of the cathedral of Bordeaux)—*Abrégé des règles de l'harmonie* (1743). Levens derives the scale from the first *ten* harmonic sounds. The fourth degree of the scale not being found among the first ten sounds of the harmonic series, he makes use of the arithmetical series in order to discover this note.

BALLIÈRE (member of the Academy of Sciences of Rouen)—*Théorie de la Musique* (1764). For the generation of chords, Ballière, like Levens, refuses in his use of the harmonic sounds to be limited by the number *six*: and betters the system of Levens by making use of the first thirteen sounds of the harmonic series.

J. F. LIROU—*Explication du système de l'harmonie* (1785). In his generation of chords by means of added Thirds, Lirou makes use of an ascending succession of sounds *c-e-g-b-d-f-a*: as well as of a descending succession, *c-a-f-d-b-g-e*.

H. F. M. LANGLÉ—*Traité d'harmonie et de modulation* (1797). Construction of chords by means of added Thirds. Langlé postulates:—"There is but one chord, that of the Third, the combinations of which produce all other chords."

J. J. MOMIGNY—*Cours complète d'harmonie et de composition d'après une théorie neuve et générale de la musique, basée sur des principes incontestables puisés dans la Nature*, etc. (1806). Momigny derives the complete major scale from the harmonics of a single string, which give him, he informs us, the sounds corresponding to *g-a-b-c-d-c-f*. But as this does not represent the correct order of tones and semitones of the major scale, he regards the string from which these sounds are supposed to be derived, *not as a Tonic, but as a Dominant!* The starting point of the natural major scale is therefore *g*, the fundamental sound of the string, and the order of its sounds may quite well be determined as *g-a-b-c-d-c-f*, so long as *g* is regarded as Dominant and *c* as Tonic. This theory has its adherents even in the twentieth century. (See Art. *Harmonics*, in *Grove's Dictionary of Music* 1906).

G. L. CHRÉTIEN—*La Musique étudiée comme science naturelle*, etc. (1811).

Chrétien follows, for the most part, the principles of Rameau. He sees in the resonance of the sonorous body the origin of harmony. All theories based on divisions of the monochord, and on geometrical calculations, are false ; harmony cannot be generated by any such methods, for neither the monochord nor geometry possesses in itself any principle of chord generation. Both may be used as a means of verifying the proportions of intervals, but they can generate no harmony and no scale. Chrétien, unlike Rameau, derives only the major harmony from the resonance of the sonorous body. The minor harmony is analogous in its construction to the major ; and is obtained by arbitrarily lowering the major Third a semitone.

Of works which appeared in Germany, there may be noted :—

J. F. DAUBE—*Generalbass in drey Accorden* (1756). The three chords of Daube are those which Rameau had already made familiar, namely (1) the major and minor harmonies ; (2) the chord of the Seventh on the Dominant ; (3) the discord $\left[\begin{smallmatrix} 6 \\ 5 \end{smallmatrix} \right]$ on the Subdominant. By means of these three chords the whole scale may be harmonized ; and whether in a central key, or in other related keys to which a modulation may be made, they constitute the sole harmonic material of a Mode. It may happen that one of the notes of the chord is chromatically altered, or even that some other note is substituted for the really essential note of the harmony (“*wenn ein Interval von einem Accorde weggelassen wird, an dessen Stelle ein anderes hinzukommt*”).

All other chords are the result of the anticipation or retardation of notes of a chord, or arise from passing-notes, etc.

C. G. SCHRÖTER—*Deutliche Anweisung zum Generalbass in beständiger Veränderung des uns angeborenen harmonischen Dreiklangs* (1772). For Schröter there is but one independent and original harmony, namely the Triad, major and minor. The chord of the Seventh arises by means of the substitution of the Seventh for the Octave ; all other combinations arise by means of the retardation, alteration, etc., of notes.

ABBÉ VOGLER—*Tonwissenschaft und Tonsetzkunst* (1776) ; *Handbuch zur Harmoniclehre* (1802). Vogler makes use of the harmonic as well as the arithmetical division of a string, which he extends to the thirty-second term. From

the sounds obtained by this process he then constructs all the chords he requires.

J. H. KNECHT—*Elementarwerk der Harmonie* (1792-8). Knecht was a pupil of Vogler. He distinguishes 3,600 different chords which may be used in the practice of harmony. Of original chords there are:—132 chords of the Seventh; 72 chords of the Ninth; 72 chords of the Eleventh, and 36 chords of the Thirteenth!

H. C. KOCH—*Musikalisches Lexikon* (1802). This work of Koch's is noteworthy in that we find again in use Kirnberger's terms "essential" (*wesentlich*) and "non-essential or accidental" (*zufällig*). Koch, however, makes use of these terms to distinguish the primary from the secondary triads of a key. Thus the essential triads in C major are *c-e-g*, *g-b-d*, and *f-a-c*; while the secondary triads are *d-f-a*, *e-g-b*, and *a-c-e*. The diminished triad (*b-d-f*) is the 3rd, 5th and 7th of the chord of the Dominant Seventh *g-b-d-f*, and is to be regarded as an incomplete form of this chord.

In the Minor Mode, the fundamental form of the scale is *a-b-c-d-e-f-g-a*. The seventh degree, however, must in certain cases be raised a semitone, that is, from *g* to *g#*. The essential triads in this mode of A minor are *a-c-e*, *e-g-b*, *d-f-a*, while the secondary triads are *c-e-g*, *g-b-d*, and *f-a-c*. In the major mode, therefore, the essential triads are all major, and the secondary triads minor; while in the minor mode the essential triads are all minor, and the secondary triads major (?). Like Kirnberger, Koch distinguishes a dissonant as well as a consonant form of the $\frac{6}{4}$ chord.

G. WEBER—*Versuch einer geordneten Theorie der Tonsetzkunst* (1817-21). Weber's *ground-harmonies* or fundamental chords are those which a multitude of text-books on harmony have made familiar. He follows Kirnberger in placing a *ground-chord*—triad, or chord of the Seventh—on every degree of the major scale. In the Minor Mode, however, neither the triad (augmented) nor the chord of the Seventh on the third degree of the scale is to be considered as a ground-chord, a curious exception, seeing that all other degrees of the scale have "ground-chords." All other combinations are the result of passing-notes, suspensions, or chromatic alteration of one or more of the notes of a ground-chord. Such are entitled non-essential discords.

F. SCHNEIDER — *Elementarbuch der Harmonie und Setzkunst* (1820). Schneider's work differs little, in its essential features, from that of Weber.

Of works by Italian theorists there may be mentioned:—

F. A. VALLOTTI — *Della scienza teorica e pratica della moderna musica* (1779). Only the first part of Vallotti's work was published. The exposition of his theory was completed by his pupil Sabbatini.

L. A. SABBATINI — *La vera idea delle musicali numeriche segnature*, etc. (1799). Sabbatini was a pupil not only of Vallotti but of Padre G. Martini. Sabbatini lays down the principle that the only numbers of significance for harmony are 1:3:5:8, which correspond to the major harmony. From this harmony all other chords are evolved: these arise, either by means of inversion, or by "accidental" sounds added to the *fundamental* consonant harmony.¹ In the minor harmony we find the same consonances as in the major, but in diverse order. Other chords which, although dissonant in themselves, are nevertheless "consonant by analogy" (*Armonie consonanti per rappresentanza*) are the diminished and the augmented chords (*b-d-f-b* and *c-e-g#-c*). The Minor Mode, like the minor harmony, has its origin in the Major.

The influence of the two great Italian theorists, Zarlino and Tartini, is strongly evident throughout Sabbatini's work. The rule which is laid down by Sabbatini for the formation of dissonant chords sounds almost like a passage from Tartini's *Trattato di Musica*. "There is not," he remarks, "nor can there be, any dissonant chord which is not based on a consonant chord."² He proceeds to develop this. The only harmonic numbers are 1, 3, 5, 8: these represent a consonant harmony, and any other number, that is, any other sound of the scale added to this harmony, will render it dissonant. In whichever part of the scale,

¹ A questo fine dico, che l'armonia ridotta alla sua corda fondamentale, fra l'intera serie, fa uso di soli tre o quattro numeri, che sono 1, 3, 5, 8, e con questi soli compone l'inalterabile suo consonante accordo. Che se poi s'introducono nell'armonia numeri diversi degli accennati, vi hanno luogo soltanto o per trasporto di armonia, o come suoni aggiunti, e accidentali (Cap. 1).

² "Non si dà, nè può darsi posizione dissonante, se non fondata sopra la posizione consonante" (Cap. 4).

entury has at least been indicated. The most strongly marked features in this development are first, the generation of the scale by means of selection from the sounds of the harmonic series, and second, the formation of chords by means of adding Thirds together. *Knecht*, with his 132 fundamental chords of the Seventh, 72 fundamental chords of the Ninth, etc., and *Vogler*, with his 32 sounds of the harmonic series, from which he derives even a Chromatic scale, would appear to represent the *reductio ad absurdum* of principles which have at least their origin in Rameau's theory. Works such as those of *Schneider* and *Weber* on the other hand are less concerned with the theory than the practice of harmony. *Weber*, indeed, declares in his work his entire disbelief in the possibility of any theory of harmony which attempts to furnish an adequate explanation of the harmonic facts; the best work on harmony, in his opinion, is that which takes account of the largest numbers of these facts, and treats of them in a practical way. This, as *Fétis* remarks, is to reduce harmony to the position it occupied at the time of *Heinichen* and *Mattheson*. One may add that it was just the existence of such a multitude of isolated facts, apparently without connection with each other, which brought about Rameau's attempt to introduce some order into the domain of harmony.

It is not surprising that at the beginning of the nineteenth century, amidst such a variety and diversity of systems, much uncertainty prevailed as to the respective merits of these systems, as to the proper basis of the theory of harmony, and as to whether indeed any adequate theory of harmony was possible. From a work on harmony by *C. S. Catel* (*Traité de l'harmonie*, Paris, 1801), we learn that in 1801 a conference of eminent musicians and professors met for the purpose of approving a system of harmony to serve for purposes of instruction in the *Paris Conservatoire de Musique*. Among the members of this conference were *Cherubini*, *Martini*, *Gossec*, *Méhul*, etc. Several systems of harmony were examined, and among them that of Rameau, which still had its adherents. The treatise of harmony of Catel was, however, ultimately and unanimously adopted as being at once the most simple and the most comprehensive. The adoption of Catel's system by the *Paris Conservatoire* marks therefore the definite abandonment in France of Rameau's

theory of harmony. It is instructive to note what this simple and comprehensive system was which the most eminent professors in France thought worthy to take the place of that of Rameau.

The basis of Catel's system of chord generation he himself explains in the following short phrase:—"There exists in harmony only a single chord, in which all the others are contained." This is not however the major or minor triad. What Catel does is to divide a string harmonically by the first nine numbers, from which sounds thus obtained he claims to derive the combination *c-c-g-b-d*, or, if it be supposed that the fundamental sound is *g*, then *g-b-d-f-a*. This Catel calls a chord of the Ninth, and takes no account of the fact that the sounds *f* and *a* are not at all the sounds which correspond with the fourth and sixth degrees of the C major scale. This chord, which in practice is called the chord of the Ninth on the Dominant, contains according to Catel the following harmonies:—

- (1) The Major Triad, *g-b-d*.
- (2) The Minor Triad, *d-f-a*.
- (3) The Diminished Triad, *b-d-f*.
- (4) The chord of the Dominant Seventh, *g-b-d-f*.
- (5) The chord of the Seventh on the leading-note, *b-d-f-a*.

By means of the extension of the series of harmonic sounds up to the seventeenth term, Catel discovers the chord of the Minor Ninth on the Dominant *g-b-d-f-a-b*; and the chord of the Diminished Seventh *b-d-f-a-b*. All other dissonant combinations are the result of retardation, anticipation, or passing-notes; or of the chromatic alteration of the harmony notes natural to the "fundamental chords" (so-called by Catel) enumerated above.

Criticism of such a system, if it can really be called a system, is needless. Catel's fundamental sound is the Dominant, which is everywhere known as the Fifth of the Tonic, and determined by the Tonic. This Dominant nevertheless forms his starting-point, and centre and foundation of his system. Several of the sounds he admits without scruple are utterly alien to any known harmonic system. But if one may construct from the sounds of the harmonic series almost any scale that one pleases, so also any one is at liberty to amuse himself by picking out, from such a series, sounds

which will give him almost any "chord" he desires. Only it is a decided mistake to label such methods "science," or "theory of harmony"!

F. J. FÉTIS.

The name of François Joseph Fétis (1784-1871), the distinguished Belgian musician, musical historian, and theorist, has several times been mentioned in connection with Rameau's theory of harmony. Fétis, as we have seen, altogether rejects acoustical phenomena as a basis for the theory of harmony, as well as all harmonic, arithmetical and geometrical progressions and proportions. The only part of Rameau's system which he accepts is that of the inversion of chords. In the by no means adequate analysis of this system which he has given in his *Esquisse de l'histoire de l'harmonie* and his *Traité de l'harmonie*, Fétis, however, does Rameau a great deal less than justice. For example, of Rameau's Fundamental Bass he remarks:—"Rameau was too good a musician not to understand that, having rejected the rules of succession and of resolution of chords, *which were incompatible with his system*, he was bound to supplement his theory with new rules. *He therefore invented his theory of the fundamental bass.*"¹ And again:—"The doctrine of the fundamental bass was, with Rameau, *only an accessory*, or one might say a complement, of his system of harmony."² We must consider that Fétis did not fully understand Rameau's theory: for it is difficult to imagine that he would wilfully misrepresent it.

It is characteristic of Fétis that he considers that all theorists before his time have been on the wrong track, and that they have altogether failed to perceive what constituted the real basis of the theory of harmony. In the *Préface* to his *Traité*, in which he expresses his confidence that he has finally succeeded in discovering the fundamental law of all music, and all harmony, he remarks:—"In vain have the most distinguished men flattered themselves that they had arrived at an adequate system by other means . . . in vain have they called to their aid mathematical science, acoustical phenomena, the

¹ *Traité de l'harmonie*, p. 206.

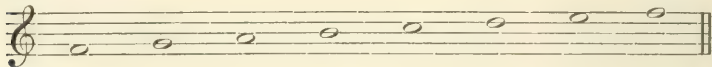
² *Ibid.*, p. 208.

distinctive qualities of various aggregations, and all the resources of which the most daring imagination could conceive. The history of their endeavours is the history of their errors." Where, then, ought one really to seek for the fundamental law of music? In "*Tonality*." "The only thing which no one seems to have dreamed of, was to seek for the principle of harmony in music itself, that is, in *Tonality*."

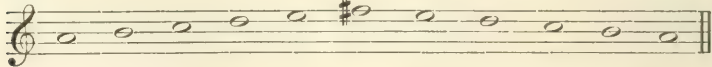
"TONALITY," WHAT IS IT?

What then is tonality? "However simple such a question may appear," says Fétis, "it is certain that few musicians could answer it satisfactorily. I say, then, that tonality resides in the melodic and harmonic affinities of the sounds of the scale, which determine the successions and aggregations of these sounds. The composition of chords, the circumstances which bring about their modification, and the laws of their succession, are the necessary result of this tonality. Change the order of the sounds of the scale, distribute their intervals differently, and the majority of the harmonic relationships cease to exist. For example, attempt to apply our harmony to the major scale of the Chinese (*a*), or to the incomplete major scale of the Irish and of the Scotch Highlanders (*b*)—our harmonic successions would become impossible in these tonalities":—

(*a*)



(*b*)



Fétis does not inform us whether the Chinese scale or the scale which he regards as that of the Scotch Highlanders has ever been adopted as the basis of harmonic music. He suggests that the harmony resulting from such scales would be quite different from our harmony. This no doubt is not far from the truth. The only question is, could it be considered as harmony at all? For example, the Pythagorean

Third *f-a*, in the first scale, is not only a dissonance for our ears, but has never been known as anything else, by any nation, in any epoch. On the other hand the Perfect Octave, Fifth and Fourth found in these scales are the "harmonies" or consonances used by musicians from the time of Pythagoras up to our own day. When, then, Fétis speaks of "our harmony," one naturally inquires what other kind of harmony is there, or has ever been in existence? The Consonances of the Octave, Fifth and Fourth, which were known to and recognized as such by the most ancient peoples possessed of a musical system, are the same in every respect as the Perfect Consonances known to and practised by us at the present day. To these we have added the major and minor Thirds resulting from the harmonic division of the Fifth, and their inversions.

Fétis proceeds:—"What I describe as Tonality then, is the order of melodic and harmonic facts which result from the arrangement of sounds in our major and minor scales; if even one of these sounds were to be placed differently, tonality would assume another character, and the harmonic results would be quite different. . . . All then, I repeat, is necessarily derived from the form of our major and minor scales, and constitutes what one calls the laws of tonality."¹

These remarks have been considered by not a few besides Fétis to be very profound and to betray a deep insight into the nature of music and harmony. In reality they are very superficial. Fétis asks us to believe that it is the scale which determines harmony and harmonic succession, whereas the reverse is the truth, as every musician knows who is acquainted with the history and development of the Church Modes. These Modes, quite different as regards the arrangement and proportion of sounds from our modern modes, were under the influence of harmony gradually altered until they assumed the form of our Major and Minor modes. It would be correct to say that harmony banished these old modes out of existence.

Fétis asks us to believe that "our harmony" has arisen apparently in quite an accidental way, through a chance combination of two or more sounds, from a scale fashioned on purely melodic principles, that is by means of measuring

¹ *Traité de l'harmonie*, p. 249.

off certain intervals so as to form a series of sounds varying in pitch, but not determined by any harmonic considerations or consonant relationships between the sounds themselves.¹ How was this scale tuned? When and where did the scale which has determined "our harmony" come into existence? Fétis cannot tell us. It is a remarkable fact, and one of theoretical importance, that of all the scales which were in use throughout Europe before the advent of polyphony, there was not one which corresponded with our major or minor scale. How then can Fétis assert that our harmony has been determined by a scale which had never been in use before the advent of harmony? Was it necessary to discover some new scale suitable for the practice of harmony? Fétis, seeing that he considers harmony to be determined by the scale, can hardly admit that it was necessary for harmony to discover and to form for itself an entirely new scale. This however is just what happened.

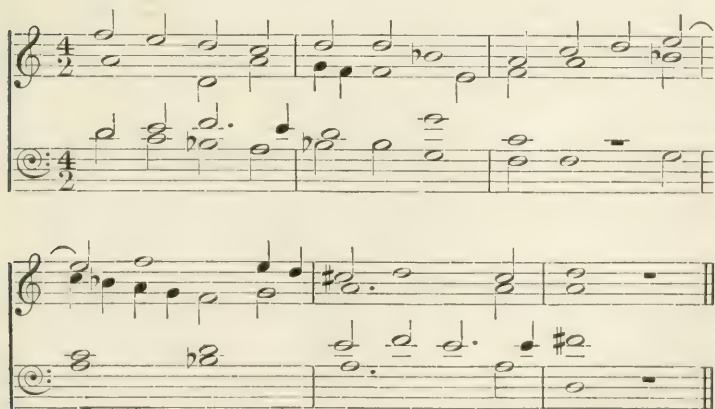
It may be thought that there was at least one of the Church modes, the Ionian, which corresponded with our major scale. This is not the case. According to the Pythagorean system of intonation of the scale which prevailed not only among the Greeks but throughout the whole of the Middle Ages, the Ionian scale presented a series of intervals which made it quite different from our major scale. Each tetrachord of the Ionian scale consisted of a succession of two whole-tones of the proportion 8 : 9, followed by a small interval of the proportion 243 : 256. There was therefore no interval corresponding to our minor tone (9 : 10) or diatonic semitone (15 : 16), while all the Thirds and Sixths were dissonant, and were expressly described as such. It was not until harmony began to be used for artistic purposes that the Pythagorean tuning of the Third began to be called in question. Ultimately this Third, consisting of two major tones, had to give way to the major Third of the proportion 4 : 5, which brought about the formation of new scales, in which the Thirds and Sixths were consonant, and the minor tone and diatonic semitone found a place.

These facts are in themselves sufficient to disprove the whole theory that "our harmony" has been determined by the scale. According to this theory, the major Third

¹ See remarks on the origin of scales, *Preface to Traité*, p. 12.

(4 : 5) (as well as the minor Third 5 : 6) ought to have been derived from some existing scale. But there was no scale in use from which such a Third could have been derived. What "occult influence," to use the language of Fétis, could have caused musicians to become dissatisfied with the Thirds they already possessed, derived from scales which had been in use for many centuries, and what could have induced them to substitute for these intervals other Thirds, derived from no one knew very well where, the effect of which was to banish, so far as harmonic music was concerned, these venerable scales entirely out of existence. Here in truth was a musical revolution; how great it is difficult for us adequately to realise. These ancient scales had their origin in Greek antiquity; they had been in use for over 1,200 years; they had become identified with the services of the Christian religion. How powerful must have been the influence which brought about their decay! This influence was Harmony.

Fétis has even less ground for his assertion that it is the order of sounds in the scale which determines "the tonality" and harmonic succession. In his *Traité* he quotes a passage from the beginning of the eight-part *Stabat Mater* of Palestrina as an excellent example of music which is in a different tonality from our own. The conclusion of the passage is as follows :—



There is no doubt as to the "modal" effect of this music. But it does not arise from the order of sounds of the scale. Palestrina writes in the Dorian Mode, but he alters it to suit the requirements of his harmony, using not only B \flat , but C \sharp , as well as C \flat . This gives what we may regard as two scales; F major and D minor, its relative minor, and he makes use of both. These are our modern scales. It cannot, therefore, be the order of sounds in the scale which gives to the music its peculiar effect, or which determines Palestrina's choice of harmonic successions. The effect is owing to the nature of the harmonic successions themselves.

Fétis does not investigate the nature of the Minor Scale, nor does he tell us how it is that while the major scale has but one form, the minor scale has three, nor why musicians constantly "change the order of the sounds" of the minor scale for themselves. Can it be that such changes are necessitated by harmonic considerations, just as in earlier times the Church composers changed the B \sharp of the Lydian Mode to B \flat , in order to obtain a better harmony, and raised the seventh degree of the Dorian and Mixolydian Modes in order to obtain a true Cadence?

THE "LAWS OF TONALITY."

Fétis proceeds to explain what he calls the "laws of tonality." One of the principal laws of tonality is that certain degrees of the scale have the character of notes of repose. The repose which characterizes these notes is not, however, owing to the arrangement of the sounds of the scale. This is owing to harmony! Only those degrees of the scale are notes of repose which admit of the harmony of the Fifth. "The first, the fourth and the fifth degrees of the scale are the only notes of repose; they alone admit of the harmony of the Fifth."¹ Immediately afterwards (p. 23), Fétis tells us that the "sixth degree also admits of this harmony."² It is not,

¹ "La tonique, le quatrième degré, et la dominante, sont les seules notes de la gamme qui sont susceptibles de prendre le caractère de repos: elles seules admettent l'harmonie de la quinte." (*Traité*, p. 22.)

² "Le caractère de conclusion et de repos attaché à cet accord lui assigne une position sur la tonique, le quatrième degré, la dominante et le sixième degré." (*Ibid.*, p. 23.)

however, a note of repose like the first, fourth and fifth degrees, but is only a note of "equivocal repose." Whatever degree of repose it possesses arises from the fact that "in the tonality of C major, it represents the Tonic of A minor." In such a case, one would imagine that this sound then represented, not the sixth, but the first degree of a scale. As for the third degree of the scale, "its tonal character is absolutely antagonistic to every sense of repose." The same is true of the second and seventh degrees of the scale.

The reason why it is the harmony of the Fifth which determines the notes of repose in the scale is that this interval alone (together with the Octave) "impresses the mind with a perfect sense of tonality, and at the same time produces in us the sensation of repose, or of conclusion."¹ The Octave and Fifth, therefore, are the only intervals of repose. The Thirds and Sixths do not convey the impression of repose: for this reason they are called Imperfect Consonances!² As for the Perfect Fourth, this is not in reality a perfect Consonance, for it does not produce the impression of repose. However it is not an Imperfect Consonance, like the Thirds and Sixths, but should be described as a "*Mixed*" Consonance.

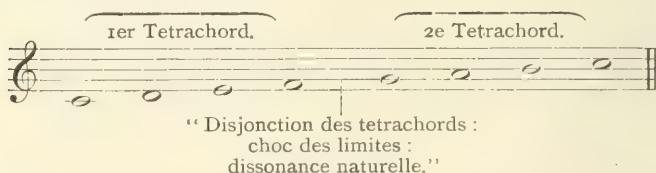
Concerning the augmented Fourth and the diminished Fifth, Fétis gives utterance to the following extraordinary remarks:—"Up to the present day," he says, "the Fourth and the diminished Fifth have caused great embarrassment to theorists. The majority have regarded them as dissonances, but without being able to deny that these dissonances are of quite a different character from those of which we shall speak immediately. . . . It is remarkable that these intervals define modern tonality by means of the energetic tendencies of their constituent sounds: the leading-note tending towards the Tonic, and the fourth degree towards the Third. But this character, which is eminently tonal, cannot constitute a state of dissonance; in reality the augmented Fourth and the diminished Fifth are employed as consonances in various harmonic successions."

¹ *Traité*, p. 7.

² "On leur donne le nom de *consonnances imparfaites*, parce qu'elles ne donnent pas le sentiment de repos."—(*Ibid.*, p. 8.)

"The augmented Fourth and the diminished Fifth are therefore consonances; but consonances of a particular kind, which I describe as 'Appellative.'" ¹

The only "natural dissonance" in the scale is that formed between the Dominant and the fourth degree. "In the order of tonal unity, these two sounds alone possess the faculty of forming a dissonance which can be taken without preparation, and without a preceding consonance." The faculty possessed by these sounds of forming a "natural dissonance" is "the result of the arrangement of the notes of the scale which, we observe, compose two tetrachords," ² thus:—



The only "natural fundamental chords" are the major and minor Triads and the chord of the Dominant Seventh. ³ All other chords are formed from these, by means of the alteration, substitution, and retardation of notes.

In all the works which have been written on the subject of harmony, it would surely be difficult to meet with anything more inadequate, contradictory, and one may say even absurd, than Fétis's exposition of his much vaunted principle of "tonality," and of what he calls "the laws of tonality." He has defined tonality as "the harmonic and melodic affinities of the sounds of the scale," resulting from the order and disposition of their sounds. But he has only a vague

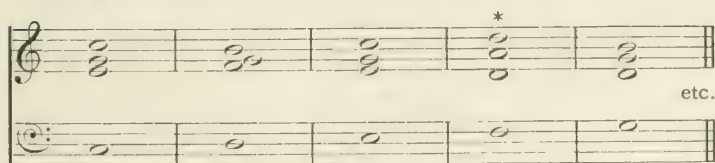
¹ "Il est remarquable que ces intervalles caractérisent la tonalité moderne par les tendances énergiques de leur deux notes constitutives, la note sensible, appelant après elle la tonique, et le quatrième degré, suivi en général du troisième. Or ce caractère, éminemment tonal, ne peut constituer un état de dissonance : en réalité, la quarte majeure et la quinte mineure sont employées comme des consonnances dans plusieurs successions harmoniques. La quarte majeure et la quinte mineure sont donc des consonnances," etc. (*Ibid.*, pp. 8, 9.)

² *Ibid.*, pp. 17, 18.

³ "Il n'y a d'accord naturel fondamental que l'accord parfait, et celui de septième de la dominante."—(*Ibid.*, p. 251.)

notion as to what the "laws of tonality" are, and how the principle of tonality is to be applied to the theory of harmony. He is quite unable to explain the "harmonic affinities" even of the sounds of the Tonic chord, as *c-e-g*. The Fifth *c-g* is an interval of repose; but the Third *c-e*, he tells us, is an interval which banishes all sense of repose. It would appear, therefore, that in a Final Cadence the concluding Tonic chord cannot be regarded as a chord of repose. That is, so long as this chord is complete. If the Third be omitted, the chord is one of repose; but if complete, it is not a chord of repose. On the other hand, the principle of tonality puts us in possession of two new "consonances"—the Augmented Fourth and the Diminished Fifth.

Again, certain notes of the scale produce in us the sensation of repose. Fétis exhibits great uncertainty as to what these notes are. At one time he definitely states that only the first, fourth, and fifth degrees are notes of repose. At other times he thinks that the sixth degree should also be included. But it would appear from Fétis's version of the "rule of the Octave," that the second degree as well is a note of repose, for he places the "perfect" chord on this degree:—¹



In the first part of his work, however, he has stated that this degree is not one of repose, and that the perfect chord placed on this degree destroys "the character of the tonality."² Only those notes which admit of the harmony of the Fifth are notes of repose. But what the Fifth has really to do with the determination of these notes as notes of repose, it is difficult to understand. Fétis, besides, has assured us that the tonality of the scale is determined by the order of its sounds.

As for the "consonance" of the diminished Fifth, Fétis does not clearly explain the "attractive affinity" of this

¹ *Traité*, p. 85.

² *Ibid.*, p. 20.

With regard to the resolutions of the dissonance at (a), Fétis considers that such a resolution establishes C as the Tonic of C major, and E as its Third. But as both the sounds which form this dissonance occur in the scale of A minor, why should C not be regarded as the Third of the Tonic chord of A minor, and E as the Fifth, or must such a succession of these sounds of the scale of A minor be considered to destroy the tonality of A minor, and establish that of C major? Besides, this dissonance is susceptible of other resolutions than the one and only resolution given by Fétis (b). The resolution in which the sound F remains stationary would, according to Fétis, appear to be a better resolution than that in which it descends a degree, seeing that F, the fourth degree, is a note of repose.

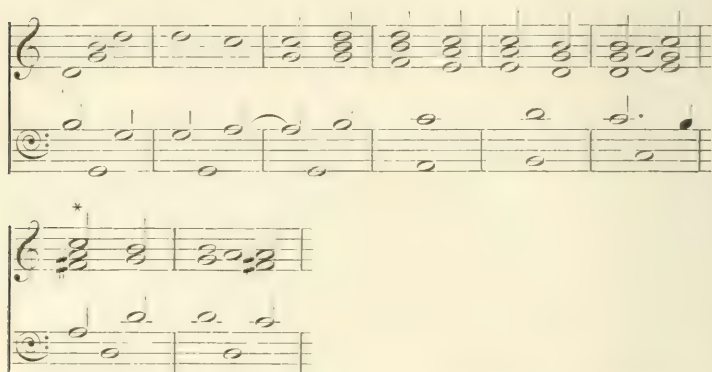
It cannot therefore be to dissonance and the necessity for its resolution that we owe our present tonality. This result might have been expected: for our major key system admits of the clearest possible definition by means of the three *consonant* major triads of the key-system. When Fétis speaks of the attractive affinity of the sounds of the diminished Fifth, he imagines he is dealing with melody only; in reality, he is dealing with harmony. What Fétis asks us to believe is that the melodic tendencies of two sounds determine the tonality of the major scale; at the same time we are to consider that it is the tonality, the order of the sounds of the major scale, which gives to these two sounds their melodic tendencies!

MONTEVERDE AND THE CHORD OF THE DOMINANT SEVENTH.

Fétis asserts that the change from the old harmonic art of the Church composers to that of the present day, which is generally supposed to have been effected about the end of the sixteenth and beginning of the seventeenth centuries, was brought about by Monteverde's employment, in one of his madrigals, of the chord of the Dominant Seventh.¹ The

¹ *Esquisse de l'hist. de l'harm.*—Art. *Monteverde*.—*Traité*, Book III., Ch. 2.

passage in which this chord occurs is quoted by Fétis, thus :—



One need not dwell on the fact that in this passage Monteverde employs harmonic combinations and successions much more astonishing than that of the chord of the Dominant Seventh; it is sufficient to note that Fétis finds in the chord at * and its progression—to the chord of \sharp —the cause and explanation of that musical revolution which has brought about our modern art of harmony. Did Fétis, learned historian as he was, really believe that such a change was brought about in such a manner? Did he really consider that while every other transformation that has been effected in the art of music has been the result of a slow and gradual development, the greatest change of all, that from the old to the new world of music, presented the sole exception to this law of development. Fétis is by no means certain; he is quite unable to make up his mind as to whether it is the chord of the Dominant Seventh which has determined "our tonality" or whether, on the contrary, it is "our tonality" which has determined for the chord of the Dominant Seventh its harmonic and theoretical significance.

If the former were really the case, we should expect to find Monteverde, his contemporaries, and immediate successors, employing the chord of the Dominant Seventh at the Tonic cadences, and especially at the Final Cadence, where above all places it was necessary clearly to define, and firmly to

establish, the new tonality. This however is not borne out by the facts. During the first half of the seventeenth century scarcely a single composer makes use, for the Final Cadence, of anything but the consonant Dominant harmony, followed by that of the Tonic. Even Lully and Alessandro Scarlatti use very seldom anything more; although with Scarlatti at least other chords of the Seventh than that on the Dominant are frequent enough.

Unfortunately the Fétis legend regarding Monteverde and the chord of the Dominant Seventh has passed into innumerable text-books on harmony and histories of music, and has become almost an article of faith among musicians. Even Helmholtz repeats it. It has been considered also that Fétis, in his remarks on this chord, was referring to the *harmonic progression* of the Perfect Cadence. But this is not the case. Fétis was referring to the melodic tendencies of the fourth and seventh degrees of the scale, both of which find a place in the chord of the Dominant Seventh. Fétis quite rightly recognizes that the chord of the Dominant Seventh is of theoretical importance. But he utterly fails to find the true explanation of it, or indeed any reasonable explanation.

Fétis considers that harmony has its roots in melody and arises from it, although he cannot explain how this is brought about. Nevertheless, he frequently speaks of the “*natural*” major and minor harmonies, and of the *natural* harmony of the Dominant Seventh. What exactly Fétis means by this use of the term “*natural*” may be ascertained from a statement he makes in the course of his analysis of the theory of L. Euler: a statement which must appear extraordinary when one remembers the ridicule which Fétis constantly pours on all theorists who make use of acoustical phenomena.

THE CHORD OF THE DOMINANT SEVENTH A “NATURAL DISCORD.”

He quotes Euler's remarks that up to the present time musicians and theorists have not gone further than the senary division of the monochord for the generation of the consonances and of harmony, and proceeds:—“This principle, which is still that of several theorists and geometricians, has been rejected by Euler in his *Mémoire* entitled *Hypothesis*

as to the origin of some dissonances commonly accepted in harmony (1764). This *Mémoire* aims at the discovery of the principles of the rational construction of the chords of the Dominant Seventh, *sol-si-ré-fa*, and of the fifth and sixth, *fa-la-ut-ré*. After having remarked that the character of the chord *sol-si-ré-fa* consists in the relationship of *si*, expressed by the number 45, with *fa*, represented by the number 64, he remarks that this last number undergoes a modification, owing to the attractive affinity of this interval; and he adds that the ear substitutes 63 for 64, so that all the numbers of the chord are divisible by 9, and in listening to the sounds *sol-si-ré-fa*, represented by the numbers 36 : 45 : 54 : 64, the ear really understands 36 : 45 : 54 : 63, which, reduced to their simplest terms, give 4 : 5 : 6 : 7.

Fétis continues:—"It is necessary to do justice to this great man . . . the philosophy of music owes to him, in the passage of the *Mémoire* from which I have just quoted, a truth as irrefragable as it is new. He has been the first to see that the character of modern music resides in the chord of the Dominant Seventh, and that its determining ratio (*rapport constitutive*) is that of the number 7."¹

Fétis, then, after having ostentatiously rejected all acoustical phenomena, not only follows Rameau in deriving harmony from the sounds of the harmonic series, but goes one better, in making use of the number 7, with which Rameau would have nothing to do. He has defined the chord of the Dominant Seventh as "the only natural dissonant chord," and as the chord which has determined our tonality. It is the only natural dissonant chord because it alone, of all dissonant chords, admits of being taken without preparation. Fétis considers it necessary to advance some reason for this, and the explanation he gives is that this chord is derived from those sounds of the harmonic series represented by the numbers 4 : 5 : 6 : 7. Yet he knows quite well that this "natural 7" is not the real fourth degree of the scale, and he constantly ridicules other theorists who make use of it.

Fétis borrows from Sorge his explanation of the origin of the Dominant Seventh chord. He follows Rameau in regarding the first, fourth, and fifth degrees of the scale as the determining notes of the key-system. He is of

¹ *Esquisse de l'hist. de l'harm.*—Art. Euler.

opinion that all theorists before his time have failed to discover the true explanation of the theoretical significance of these sounds. Whether this be so or not, it is certain that this problem of "tonality" is one which completely baffles Fétis. Fétis invites us to consider that the order of the sounds of the scale has determined "our harmony": that this is so is proved by the fact that it is "our harmony," and especially that of the natural Seventh, which has determined the order of the sounds of the scale!

CHORD RELATIONSHIP AND SUCCESSION.

According to Fétis, the chief defect of Rameau's system is that the chords he generates appear as isolated chords, existing without inner connection. But chords, he quite rightly argues, are in harmony more or less closely related to each other, and one of the principal difficulties of harmony is to explain the nature of this harmonic relationship and the laws of harmonic succession. It is in connection with these difficulties that Fétis has led us to expect the principle of tonality to be most productive of theoretical results. It is just here, however, that this principle appears to be most barren of results. Fétis is quite unable to explain chord succession, nor has he any adequate explanation to offer of the nature of harmonic relationship, even such a close and direct relationship as that existing between a Tonic and its Dominant, between Tonic and Dominant harmonies, and between Tonic and Dominant keys. It is impossible for Fétis to maintain that his principle of "tonality" affords any adequate explanation of harmonic relationship or of the principles which lie at the root of harmonic succession.

He, however, accepts Rameau's theory of harmonic inversion. This part of Rameau's theory he describes as "a stroke of genius." But he does not appear to realise all that it implies. He rejects Rameau's theory of the fundamental note, but nevertheless considers himself at liberty to speak of "fundamental" and even "natural" chords, and to make use of Rameau's theory of inversion for his own theory of harmony. But how then is Fétis able to determine that, for example, the Fourth is an inverted Fifth? May

not the Fifth be an inverted Fourth? As he regards *f*, in the key of *c*, not as the Fifth below *c* but as the Fourth above it, should not *c-f* in this case be regarded as a fundamental interval, and *f-c*, the Fifth, as its inversion? For the same reason, should not the chord *f-a-c* be regarded as the inversion of the chord *c-f-a*? Fétis no doubt would object that this is not in accordance with the principles of "tonality"—an explanation which might be illuminating if Fétis could inform us what the principles of "tonality" really are.

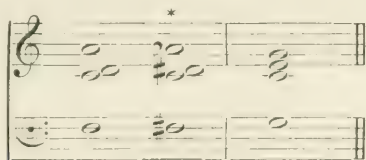
But, it might be urged, seeing that the Fifth is a more perfect consonance than the Fourth, the Fifth ought to be regarded as the original and fundamental interval, and the Fourth its inversion. But this does not follow. "Tonality" is a somewhat hazardous foundation on which to build up a theory of inverted chords, and a somewhat uncertain means of determining whether chords are inverted or fundamental. But without the theory of inverted chords no theory of harmony is possible.

Again, Fétis looks on the scale as consisting of an *ascending* series of sounds. He merely assumes, however, that this is so in reality. It is certain that this was not the sense in which the scale was originally understood. The Greek conception of the scale was that of a *descending* series of sounds. As Fétis is of opinion that all music and harmony have their origin in scales, he might have been expected to adopt the view of the Greeks, which is the historically correct view. At the same time, it would have been necessary for him to point out that the modern theory and practice of harmony are based on a misconception as to the real nature of the scale.

"ALTERED" AND "CHROMATICALLY ALTERED" CHORDS.

A great part of his *Traité* is devoted by Fétis to the explanation of the various ways in which "fundamental" chords may be modified. He here develops Kirnberger's theory of the modification of fundamental chords by means of the prolongation (suspension), substitution, and alteration of notes of a chord. For example, in the first inversion of the chord of the Dominant Seventh *b-d-f-g*, the note *a* may be substituted

for *g*, and the chord may appear as *b-d-f-a*. Again, the tonic chord *c-e-g* may appear as a chord with chromatically altered Fifth, thus, *c-e-g#*. Here, of course, the question arises—how much alteration may a Tonic chord undergo before it ceases to be a Tonic chord? May not *c-eb-g#* be also regarded as an altered Tonic chord? Fétis himself gives examples of chords in which as many as three of the original sounds of the chord are chromatically altered. Thus in the following:—



he explains the second chord as derived from the first; that is, it represents a chromatically altered form of the harmony *f-a-c-d*. One may assert on the contrary that the second chord does not at all represent the harmony *f-a-c-d*, but an altogether different harmony. If Fétis holds that the chromatic alteration of the first chord does not change the harmonic meaning and significance of the chord, he is plainly in error. If, on the other hand, he considers that such an alteration does actually change the nature of the chord, he has not considered it necessary to explain the nature of this change. But as Fétis considers that harmony arises from melody, why should he not consider the second chord to be an entirely independent harmony, representing nothing but itself? Anything more ill-considered, more inadequate than Fétis's "metaphysical" theory of harmony based on the principle of *tonality* which he himself does not understand, and is unable to explain, it would be difficult to conceive.

CHAPTER XII.

HAUPTMANN; HELMHOLTZ; ÖTTINGEN; RIEMANN, ETC.

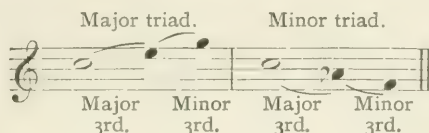
MORITZ HAUPTMANN.

WITHIN a few years of the publication of the *Traité de l'harmonie* of Fétis, there appeared the remarkable work by Moritz Hauptmann—*Natur der Harmonik und der Metrik* (1853), undoubtedly one of the most important and valuable works on harmony which we possess. Hauptmann's musical insight, sound musical judgment, and clear discernment of harmonic facts, have been surpassed by no other theorist. The examination of the various existing systems of harmony appears to have convinced Hauptmann of the inadequacy of acoustical phenomena or of mathematical proportions and progressions as a basis for the theory of harmony. In the *Introduction* to his work he remarks:—"It has always been the custom to begin text-books of Thorough-bass and Composition with an acoustical chapter, in which the relations of the intervals were set out by the number of the vibrations or length of the strings." After a reference to the familiar process of chord-formation by means of sounds selected from the harmonic series, and the necessity for the modification of the natural sounds so obtained, he proceeds:—"Of the theory which seeks to trace the reason of all harmony in the so-called partial tones, it need only be remarked that even if the third and fifth partial tones are those most distinctly heard, nevertheless the other sounds of the harmonic series, indeed of the infinite harmonic series, must equally be regarded as partial tones, and as constituents of the fundamental or ground-tone; for example, the seventh and ninth partial tones may frequently be quite distinctly heard. . . .

"We may therefore disregard this partial-tone theory, as well as that other theory which supposes that the key to

harmony is to be found in the continued arithmetical series, a theory which is both untrue to fact and in disagreement with what is musically natural."

Like Rameau and Tartini, Hauptmann is convinced that there exists but a single original and fundamental chord, from which all other chords are derived, namely, the major harmony. The minor harmony, which is as truly a harmonic unity as the major, is an inverted major harmony:—



This being so, it is clear that there are but three intervals which are "directly intelligible," namely, the Octave, Perfect Fifth, and Major Third. In the major triad *c-e-g*, the major third *c-e* determines the minor third *e-g*. The minor third is not a "directly intelligible" interval. The Octave, Fifth, and Major Third are the sole positive constitutive elements of harmony.

If it is from this triad of sounds and of intervals that all chords are derived, it is from a "triad of triads"—the Tonic, Dominant, and Subdominant triads—that our key-system is derived and by means of which it is determined. In the treatment of dissonant chords, Hauptmann also discerned a three-fold process:—First, we have the consonant triad or harmonic unity (*Preparation*), next, the state of opposition created by the clashing of the dissonant harmonic elements (*Percussion* or *Suspension*), lastly the removal of these opposing elements, or reconciliation in a fresh unity (*Resolution*).

These and other similar facts relating to harmony led Hauptmann to the belief that the principle from which harmony proceeds, which underlies all music and which renders it universally intelligible, must be a metaphysical principle. His reflections on the æsthetic side of his art confirmed him in this belief. "Although," he remarks, "the contents of the complicated work of art may make it difficult to be understood, nevertheless the means of expression are always

the same, and singly are intelligible universally. . . . The triad is consonant for the uneducated as well as for the educated : the dissonance needs to be resolved for the unskilled as well as for the musician ; discordance is for every ear something meaningless. . . . That which is musically right, correct, addresses us as being humanly intelligible. . . . That which is musically inadmissible is not so because it is against a rule determined by musicians, but because it is against a natural law given to musicians from mankind ; because it is logically untrue and of inward contradiction. A musical fault is a logical fault, a fault for the general sense of mankind, and not for a musical sense in particular." These significant remarks might in themselves be held to prove Hauptmann's worth as a great theorist and musician.

Hauptmann then concludes, as Rameau also concluded after his own fashion, that the principle on which music is based must be a principle which operates everywhere, in the simplest as well as in the most complicated work of musical art, and not only in harmony but in melody and rhythm as well. He therefore, as is known, gives to his theory of harmony a metaphysical basis, the principle of which he borrows from Hegel and which he enunciates thus :—"Unity, with the opposite of itself, and the removal of the opposite," or (1) Unity ; (2) Duality or separation, and (3) Union. It may be at once remarked that the dialectical method pursued by Hauptmann, applied as it is for a scientific purpose, is altogether unsuitable and inadequate. Evidently one of the principal difficulties of such a method is to determine exactly the premises from which the inference or conclusion has to be drawn.

OCTAVE, FIFTH, AND MAJOR THIRD THE ONLY

" DIRECTLY INTELLIGIBLE INTERVALS."

One of Hauptmann's first tasks is to explain the major harmony ; and it is somewhat surprising to find that no sooner has he begun the exposition of his theory than he conducts us into the now familiar region of acoustical phenomena (*Major Triad*). In demonstrating that the

only "directly intelligible" intervals are the Octave, Fifth, and Major Third, he proceeds thus:—

The *Octave*¹ is the expression for *Unity*; the *Fifth* expresses *Duality* or separation ($\frac{2}{3}$ of a string is heard against the ground-tone); the *Third*, *Unity of Duality* or *Union* ($\frac{1}{3}$ of the string is heard against the ground-tone). The Third is the union of Octave and Fifth.

The unifying property of the Third, Hauptmann demonstrates thus:—"The *Third*: the interval in which a sounding quantity of four-fifths is heard with the ground-tone. Here,

¹ "The *Octave*: the interval in which the *half* of the sounding quantity makes itself heard against the *whole* of the ground-tone, is, in acoustical determination, the expression for the notion of *Identity*, *Unity*, and *Equality with self*. The half determines an equal to itself as other half."

"The *Fifth*: the interval in which a sounding quantity of *two-thirds* is heard against the ground-tone as a whole, contains acoustically the determination that something is *divided within itself*, and thereby the notion of *duality* and *inner opposition*. As the half places outside itself an equal to itself, so the quantity of two third-parts, heard with the whole, determines the third third-part; a quantity to which that actually given appears a thing *doubled*, or in *opposition with itself*." *Harmony and Metre* (Major Triad).

It is unfortunate that Hauptmann should find it necessary for his argument to make use of two kinds of acoustical determination for the Octave, as well as for the Fifth. He first expresses the Octave as $\frac{1}{2} : 1$, which is the correct acoustical determination. But he finds it necessary, in order that the Octave may be understood as *Unity*, to give it quite a different determination, namely $\frac{1}{2} : \frac{1}{2}$. This, however, does not express the Octave, but the Unison.

Similarly for the Fifth, which is first expressed as $\frac{2}{3} : \frac{3}{3}$, but which represents *Duality* only if understood as $\frac{2}{3} : \frac{1}{3}$. This, however, is the expression for the octave, which, Hauptmann assures us, represents *Identity*, *Unity*.

As, according to Hauptmann, *Duality* is "a thing doubled," then the Octave must be the constant expression for *Duality*, for the Octave is acoustically determined as $1 : 2$.

It is evident that Hauptmann, by comparing the true acoustical determinations of the Octave ($1 : 2$ or $\frac{1}{2} : 1$) and Fifth ($2 : 3$ or $\frac{2}{3} : \frac{3}{3}$) might have arrived at quite different results. He might also have followed Rameau in deriving the Octave, Fifth, and Third from the harmonic sounds of the sonorous body, represented by the numbers $\frac{1}{2} : \frac{1}{3} : \frac{1}{5}$. Hauptmann, however, does not accept these natural determinations. If he did, his argument would fall to pieces. But it is, in short, impossible to demonstrate the facts of harmonic science by the Hauptmann system of dialectics.

the quantity determined is the fifth fifth-part, of which that given is the quadruple, that is, twice the double. In the quantitative determination of twice two, since the double is here taken together as unity in the multiplicand, and at the same time held apart as duality in the multiplier, is contained the notion of the identification of opposites, of Duality as Unity." This is surely the most extraordinary explanation ever advanced to account for the consonance of the Fifth. As the Third, *in itself*, represents a "unity of duality, or union," *therefore* it renders the Fifth consonant!

So then, concludes Hauptmann, "the conditions of the idea or conception of Consonance are completely fulfilled in the sound combination, Ground-tone, Fifth, Third." Rather, Hauptmann completely fails to give any adequate or correct idea as to the real meaning of these intervals for harmony, of the varying *degrees* of consonance which they express, and by which they are differentiated. ((1) Unison; (2) Octave; (3) Fifth; the Third = an Imperfect Consonance.)

It is plain that the Hauptmann system of dialectics applied to acoustical determinations may be made to produce almost any result. One can only regret that so much ingenuity should have been expended on the attempt to prove what is plainly in entire contradiction with the facts. According to Hauptmann, the Fifth in itself must be regarded as virtually a dissonance. It may, however, become a consonance, but this can only be effected by the mediation of the Third! Hauptmann might have considered that nearly all ancient peoples, to whom the Third as a consonance was unknown, nevertheless regarded and described the Fifth as a consonance. One would naturally have expected Hauptmann to postulate like Zarlino, Rameau, and other theorists, the fundamental sound, rather than the Octave, as Unity. In that case, however, the Octave might have appeared as Duality, and the Fifth as the uniting element.

The principle laid down at the outset by Hauptmann, on which his whole theory is based, that the Octave, Fifth, and Major Third are the only "directly intelligible" intervals, has been hailed especially by German theorists as a notable and astonishing achievement, which marks a new epoch in harmonic science. But it was Rameau who, following Descartes, first clearly showed that the Octave, Fifth and Major Third are the only consonances employed in music

which are directly intelligible in the sense that they alone arise directly from, and are directly related to, the fundamental note. The other intervals were "derived" from these three. Rameau took this as his starting point, developed from it his theory of Harmonic Inversion, and rightly insisted that it formed the only possible basis for such a theory, and consequently for any rational theory of harmony. Hauptmann's acumen as a theorist is evidenced by his recognition of the necessity which existed to prove at the outset that the Octave, Fifth and Major Third are, in Rameau's language, "fundamental," and not "derived" intervals. But while Hauptmann fails to prove this fact, Rameau demonstrates its truth in the most complete and convincing way. According to Hauptmann, the Fifth represents "duality, inner opposition"; nevertheless, he considers it to be a "directly intelligible interval." It is strange that Hauptmann, who found himself obliged to call in the aid of acoustical phenomena in order to find a firm basis for his "metaphysical" theory of harmony, should nevertheless have rejected Rameau's method; but in rejecting it, he rejects the only means whereby the intervals of the Octave, Fifth, and Major Third can be established as "fundamental," or "directly intelligible."

THE KEY-SYSTEM.

Hauptmann proceeds:—"In the notion of the unity of the three elements of the triad there is contained, in brief, all determination which underlies the understanding, not only of chords as the simultaneous union of notes, but also of melodic progression and succession of chords." As already indicated, Hauptmann finds in the primary Triads of Tonic, Dominant, and Subdominant ("Unity of a triad of triads") the complete means for the determination of *Key*. In order to help out his argument, he finds himself obliged to bring in two new *Conceptions*, namely, that of *Having*, and that of *Being* ("having" a Dominant, and "being" a Dominant). After some laborious reasoning, Hauptmann decides "not to weary the reader with too abstract conceptions," and presents to us the two triads which are, he tells us, and which we know to be in reality, in opposition with each

other, although the opposition is not that of the Fifth, namely, the triads of Dominant and Subdominant, $\begin{matrix} \text{I} & \text{III} & \text{II} \\ & \text{F} \text{---} a \text{---} C \end{matrix}$ and $\begin{matrix} \text{I} & \text{III} & \text{II} \\ & G \text{---} b \text{---} D. \end{matrix}$ (Here I = Ground-tone; II = Fifth; III = Third).

How, then, do these triads arise? Both are derived from the Tonic triad = $\begin{matrix} \text{I} & \text{III} & \text{II} \\ & C \text{---} e \text{---} G \end{matrix}$. G changes its character as Fifth, and becomes ground-tone = $\begin{matrix} \text{I} & \text{III} & \text{II} \\ & G \text{---} b \text{---} D \end{matrix}$: while C changes its character as ground-tone, and becomes Fifth = $\begin{matrix} \text{I} & \text{III} & \text{II} \\ & F \text{---} a \text{---} C. \end{matrix}$ In the Subdominant triad, therefore, C,

the Tonic and central note of the whole key-system, appears as Fifth of F. As Hauptmann reckons intervals upwards, he evidently does not feel justified in describing F as Fifth of C. But while the two triads, Dominant and Subdominant, are certainly in opposition with each other, one looks in vain for any Fifth connection or rather opposition between them. Nevertheless, asserts Hauptmann, these two triads represent Duality, that is, the Fifth. They can only be reconciled and their opposition removed by the mediation of the Tonic triad, which then appears as the uniting Third element.

Another question remains to be decided. Which of the two triads, Dominant and Subdominant, represents Unity, and which Duality? It is the latter which, according to Hauptmann, represents Unity (I), and the former, Duality (II); although how he arrives at this result it is difficult to discover. The complete key-system, therefore, appears thus:—

$$\begin{matrix} \text{I} & \text{III} & \text{II} \\ \text{F} \text{---} a \text{---} C & \text{---} e \text{---} G & \text{---} b \text{---} D^1 \end{matrix}$$

This is the formula given by Hauptmann himself. The Subdominant triad appears as the root of the whole key-system. As for the Tonic triad, this represents not only the original Unity, but is itself the uniting Third element. This is quite a different result from that of the original major triad. But this is not a complete account of the extraordinary

¹ *Harmony and Metre*, "Major Key."

metamorphosis which the Tonic chord has to undergo before the key-system can become established. For first it is Unity=I; then it is Duality=II (being Dominant of the Subdominant triad); lastly it is the uniting Third element=III.

Surely no theorist was ever in greater straits than Hauptmann in his attempt to explain the key-system by means of this organic "life-" or "world-process" which he conceives to be the simple and universally intelligible fundamental principle of all music.

If Hauptmann would but carry out strictly his own philosophical principle, his course is perfectly plain. If the original Tonic C-e-G represent the fundamental Unity, then G-b-D must represent the Fifth duality, for G is Fifth of C; and the triad E-g#-B will represent the mediating triad, for E is the Third. So then we get the perfectly logical system:—

$$\begin{array}{ccc} \text{I} & \text{III} & \text{II} \\ \text{C} \text{---} e \text{---} G & \text{E} \text{---} g\# \text{---} B & \text{G} \text{---} b \text{---} D \end{array}$$

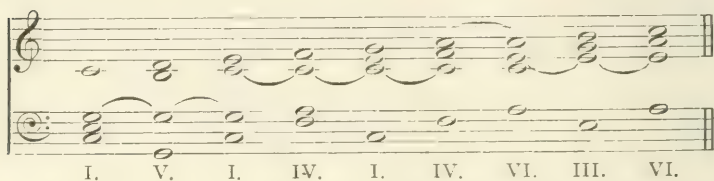
or rather, the system which logically results from the strict carrying out of Hauptmann's philosophical principles. But so far as the ear is concerned, if it may be left to the ear to decide anything relating to a musical system based on Hegelian metaphysics, there does not appear to be much unity in this "triad of triads." But one must not blame Hauptmann for being a better musician than a philosopher!

For Hauptmann, then, as for Rameau, the scale is harmonically determined; that is, each note of the scale is derived from one or the other of the three determining chords. It is harmony which determines melody and melodic succession. The melodic passage C-e-G is harmonically determined. Not less is the succession C-b or C-D, for b is Third, and D is Fifth of the Dominant triad G-b-D. Hauptmann expressly states:—"No melodic note can receive definiteness otherwise than it is conceived as Ground-tone, Third, or Fifth of a triad."¹ Thus are determined "the sixth [degree of the scale] as Third of the Subdominant; the seventh, as Third of the Dominant; the eighth, as Octave of the Tonic."²

¹ *Harmony and Metre*, "Passing-notes."

² *Ibid.*, "Scale of the Major Key."

But while Hauptmann explains C-D-c, the first three degrees of the scale of C major, as determined by a Tonic-Dominant succession of chords, and e-F-G-a by a Tonic-Subdominant succession, the sounds a-b-C—the sixth, seventh, and eighth degrees of the scale—he considers to be determined by a Submediant-Mediant harmonic succession :—



“ Thus the whole scale is formed : in its first, second, and third degrees, on the Fifth ; in its fourth, fifth and sixth degrees, on the *Ground-tone* ; in its sixth, seventh and eighth degrees, on the *Third* of the Tonic.”¹ Hauptmann’s satisfaction with so symmetrical an arrangement appears to have caused him to overlook the decided contradiction implied in this double determination of the sixth, seventh, and eighth degrees of the scale. The scale concludes with a minor harmony ; there is no real close or cadence between leading note and Tonic, while the latter part of the scale is in the key of A minor, rather than that of C major. Not three but five “ harmonic unities ” are necessary for the determination of the scale-succession. Hauptmann experiences the same difficulty as Rameau in this part of the scale—*a* as Third of the Subdominant, and *b* as Third of the Dominant triad cannot succeed one another. For this it would be necessary that the two disjunct triads Subdominant-Dominant should succeed one another immediately. Such a succession, however, would be unintelligible, for there is no “ common element,” no connection between the two triads.² It would appear, then, that for the determination of the sounds of the major key-system, a “ triad of triads ” is insufficient. Other “ harmonic unities ” than those on the Tonic, Dominant, and Subdominant are necessary, namely, the triads on the Mediant and Submediant.

¹ *Harmony and Metre*, “ Scale of the Major Key.”

² *Ibid.*

SECONDARY TRIADS OF THE KEY-SYSTEM.

But where does Hauptmann discover the two minor triads which he has been obliged to introduce for the harmonization of the scale? He explains the matter thus. Between each pair of major triads there exists a minor one. Thus, between Tonic and Dominant triads we find the minor triad on the Mediant: $\text{C}—\text{c}—\text{G}—\text{b}—\text{D}$, while between Subdominant and Tonic triads we find the minor triad on the Submediant: $\text{F}—\text{a}—\text{C}—\text{e}—\text{G}$. Two other triads may be derived from the scale by a process of joining together the limits of the key-system, thus: $\text{D}|\text{F}—\text{a}—\text{C}—\text{c}—\text{G}—\text{b}—\text{D}|\text{F}$. These triads are $\text{D}/\text{F}-\text{a}$ and $\text{b}-\text{D}/\text{F}$. Both are dissonant; both “have a duality of basis,” and, properly speaking, they are not triads at all. Hauptmann is truer to fact in his treatment of these chords than many of his predecessors: $\text{D}—\text{a}$, as well as $\text{b}—\text{F}$, are not perfect, but diminished Fifths; and both triads are “diminished triads.”

But, one would imagine, the minor triads $\text{c}-\text{G}-\text{b}$, and $\text{a}-\text{C}-\text{e}$, the Mediant and Submediant triads of C major, although their Fifths are perfect, have nevertheless likewise a “duality of basis,” and should therefore be regarded as dissonant triads. Thus in the Mediant triad $\text{c}-\text{G}-\text{b}$, c is Third of the Tonic triad $\text{C}-\text{e}-\text{G}$, while $\text{G}—\text{b}$ represent the Ground-tone and Third respectively of the Dominant triad $\text{G}-\text{b}-\text{D}$. But another explanation is possible for this triad. For $\text{c}-\text{G}$ may be regarded as Third and Fifth respectively of the Tonic triad, and b as Third of the Dominant triad. Similarly for the Submediant triad $\text{a}-\text{C}-\text{e}$, which may likewise represent a duality.

Hauptmann, however, does not take this view. Each of the triads in question he regards as a harmonic unity. In the triad $\text{a}-\text{C}-\text{e}$, e , he states,¹ is Fifth of a ; and in the triad $\text{c}-\text{G}-\text{b}$, b is Fifth of c . So also in the chord succession $\text{C}-\text{c}-\text{G}—\text{C}-\text{e}-\text{a}$, we pass from one to another harmonic unity; such a succession is “only intelligible in so far as both can be referred to a common element which changes meaning during the

¹ *Harmony and Metre*, “Scale of Major Key.”

passage.”¹ Here the common element which changes meaning consists of the sounds C-*e*, common to both chords. That is, *e* changes its meaning as Third and becomes Fifth, while C changes its meaning as root, and becomes Third. Why then does not Hauptmann give to the second chord its proper notation?²

It is remarkable that he should employ the wrong notation for the Mediant and Submediant triads. Thus the Submediant triad he designates as *a*-C-*e*, although he expressly states that *e* is Fifth of *a*. C, then, is the Third of the chord. These triads, therefore, should have the notation A-*c*-E, and E-*g*-B. But in such a case we find five degrees of the scale not only doubly determined, but with their original meanings entirely reversed. Hauptmann’s difficulty with regard to the notation of these triads can therefore be understood.

The key-system, Hauptmann points out, may be shifted slightly upwards without inducing a change of Mode. Suppose, he remarks, we shift the key-system $\overbrace{F-a-C-e-G-b-D}$, a little in an upward direction, thus : $\overbrace{a-C-e-G-b-D-f\sharp}$, we must not imagine that the introduction of the note *f* \sharp necessarily implies a modulation to the key of G major. For here G has not full Tonic meaning : for the first key-system has only given up F, not *a* as well. On the other hand, if we shift the same key-system downwards so as to include B \flat thus : $\overbrace{B\flat-d-F-a-C-e-G}$, we have a real modulation to F major. Here the chord F-*a*-C appears as central Tonic chord. The manner in which Hauptmann explains a modulation to the Dominant key is, then, apparent. He does not attempt to show that the relationship between the two keys can be established only through the mediation of the key of the Third—the Mediant E major.

¹ *Harmony and Metre*. “Chord Succession.”

² As is known, Hauptmann devised a new method of designating the harmonic triad ; as he justly remarks, theorists have not been careful enough to distinguish in the notation employed, between the Third-meaning and Fifth-meaning of a sound : Thus *e*, the harmonic Third of the triad C-*e*-G, is quite a different sound from E, the fourth Fifth of C. This E is the Pythagorean, and not the true harmonic Third of C. While *e* then, has Third-meaning, E has Fifth-meaning, and this distinction must be carefully observed. For Ground-tone and Fifth Hauptmann therefore makes use of capital letters, and for Thirds, small letters.

ORIGIN OF DISCORDS : DIMINISHED TRIADS AND
CHORD OF THE "ADDED SIXTH."

In Hauptmann we meet with what, at first sight, appears to be the "double employment" of the Seventh chord on the Supertonic. He presents us with the two chords D/F-*a*-C, and *d*-F-*a*-C. These chords differ from one another. In the first chord, D is the Fifth of the Dominant triad G-*b*-D; in the second, *d* is the Third of B \flat . "The chord on the Fifth of the Dominant of the major key D/F-*a*," he remarks, "must not be confounded with the minor triad *d*/F-*a*, which, transgressing the lower limit of the C major key-system, is formed upon the Third of B \flat , with ground-tone and Third of the major triad of F." ¹

This can mean nothing but that the triad *d*-F-*a* cannot belong to the C major key-system. The chord of the Seventh on the Supertonic of C major can therefore assume only one form, namely, D/F-*a*-C; the other chord *d*-F-*a*-C must of necessity be that on the sixth degree of the scale of F major. There can, therefore, be no "double employment" of the chord of the Supertonic Seventh in C major, or indeed in any key.

Hauptmann's explanation of this important chord D/F-*a*-C differs from that given by Rameau. It will be remembered that Rameau considered this chord to be formed by the addition of a Third *below* the Subdominant harmony. It is true that he also explained it as arising from the addition of a Sixth *above* the Subdominant harmony, and that he regarded this chord of the Added Sixth F-*a*-C/D as an original chord. In both cases, however, he insisted that the fundamental harmony was that of the Subdominant, F-*a*-C. Hauptmann, on the other hand, can comprehend the chord of the Seventh—all chords of the Seventh—only as a triad-duality. "The chord of the Seventh is the sounding together of two triads

joined by a common interval" ² (as $\overbrace{a-C-e} \quad C-e-G$)

"Only those triads which have a harmonic unity, that is a common interval, can be taken together at one time; therefore only two triads which are related in two notes."

¹ *Harmony and Metre*, "Diminished Triads."

² *Ibid.*, "Chord of the Seventh."

By means of the joining together of a major with a minor triad we obtain in C major the following chords of the Seventh :

$\overbrace{C-e-G-b}$, $\overbrace{c-G-b-D}$, $\overbrace{F-a-C-e}$, and $\overbrace{a-C-e-G}$. But there are three other important chords of the Seventh distinguished

by Hauptmann, namely, $\overbrace{D/F-a-C}$, $\overbrace{G-b-D/F}$, and $\overbrace{b-D/F-a}$. These chords are more important than any other chord of the Seventh ; for, as they contain the interval $\overline{D/F}$ which represents the joining together of the limits of the key-system, they are of the greatest possible value for defining the key. How, then, are these three important chords formed ? The first chord contains the diminished triad $D/F-a$; the second, the diminished triad $b-D/F$, while in the third chord we find both diminished triads. These triads are not harmonic unities ; Hauptmann has rightly pointed out that they cannot properly be regarded as triads at all. He now finds it necessary to contradict his former statement, for he is quite unable to account for the formation of the three most important Seventh chords of the key-system except by explaining these diminished triads as harmonic unities.

"The diminished triads," he states, "must also be regarded as organic chord-formations. The chords of the Seventh $G-b-D/F$, $b-D/F-a$, $D/F-a-C$, although the line of separation indicates the derivation of their elements from the Dominant and Subdominant triads, are none the less established as combinations of triads. The chord $G-b-D/F$ cannot have organic meaning as a union of the Dominant triad with the Subdominant ground-tone, nor the chord $D/F-a-C$ as a union of the Dominant Fifth with the Subdominant triad. Only things of like kind can be united. With the triad only the triad can enter into union, but not the single chord-element, the solitary note."¹ Hauptmann must have been in great straits when he found himself obliged to explain the diminished triad $b-D/F$ as an "organic chord-formation" (*organische Accordbildung*) and of harmonic meaning (*von gleicher Begriffsgattung*) similar to the major triad $G-b-D$. Perhaps it is, but not according to Hauptmann's system.

Beyond all question, Hauptmann's designation of the

¹ *Harmony and Metre*, "Resolution of Dissonance."

diminished triads as $b\text{-}D\text{/}F$ and $D\text{-}F\text{/}a$ indicates their duality of origin ; and this is true also of the two minor triads $e\text{-}G\text{-}b$ and $a\text{-}C\text{-}e$, where, instead of ground-tone, Third, and Fifth, we find two Thirds and a ground-tone. His explanation of the Dominant and Subdominant discords cannot be regarded as an advance on that of Rameau.

RESOLUTION OF DISSONANT CHORDS.

Hauptmann's theory of the resolution of dissonance is characteristic of his system. The essence of dissonance, he remarks, is that a note is determined as at once ground-tone and Fifth. Thus, in the dissonance $C\text{-}D$, it is G which is determined as simultaneously Ground-tone and Fifth :—

I—II

$C\text{—}G\text{—}D$. C may proceed to b , or D to e . In either case
I—II

the dual character of the sound G disappears. In the first case G is definitely established as ground-tone ; in the second case C is ground-tone.

It is thus that the resolution of the chord of the Seventh is determined. " For example, in the chord of the Seventh $e\text{-}G\text{-}b\text{-}D$, which comprises the duality $e\text{-}G\text{-}b$ and $G\text{-}b\text{-}D$, the notes e and D are as yet without relation to one another. The required note, which brings about the relation, is here a , to which e stands as Fifth and D as ground-tone. Thus the note a must enter instead of the Third-interval $G\text{-}b$, whereby instead of the chord of the Seventh $e\text{-}G\text{-}b\text{-}D$ there is produced the chord of suspension $e\text{-}a\text{-}D$. And now the linking note a may be regarded as Fifth of D or ground-tone of e ; both of which meanings are now contained in it at one and the same time. Therefore e will either proceed to F , or D to C ; and from $e\text{-}a\text{-}D$ there will arise either $F\text{-}a\text{-}D$ or $e\text{-}a\text{-}C$." ¹

This theory leads to some curious results. The resolution of the chord of the Tonic Seventh $C\text{-}e\text{-}G\text{-}b$, for example, has to be explained thus :—The dissonance is $C\text{—}b$, C is Fifth of F , and b is its ground-tone, etc. As to the dissonance $b\text{—}/F$ in the chord of the Dominant Seventh $G\text{-}b\text{-}D\text{/}F$, Hauptmann is at a loss, and can only speak of the " attractive tendency "

¹ *Harmony and Metre*, " Resolution of Dissonance."

of the interval : *b* tends towards *C*, and *F* towards *e*. Again, speaking of the resolution of the chord of the Seventh *e-G-b-D*, he remarks :—" Here *b* is Third of the triad *G-b-D*, and Fifth of the triad *e-G-b*; but *must become ground-tone of the diminished triad b-D/F* for the resolution to be determined upon it. For again, *e-b-D* can only reach resolution in *F-b-D*." ¹ These cannot be regarded as very satisfactory results. Hauptmann is here at the mercy of his system.

The dissonant Augmented triad has to be explained somewhat differently from the chord of the Seventh. Of the chord *e♭-G-b*, which occurs on the Mediant of the key of C minor, Hauptmann says that in this chord " the middle note *G* is in itself decided duality; it is determined differently in two directions at the same time, as positive and negative ground-

e♭-G-b " ²
tone, thus :— III—I
 I—III

The chords of the Augmented Sixth *a♭-C-f♯* and *a♭-D-f♯*, are explained by Hauptmann as arising from the union of the extremes of the C minor key-system extended in an upward direction, thus *a♭-C-e♭-G-b-D-f♯*. The original form of these chords is therefore *f♯/a♭-C* and *D-f♯/a♭*.

Hauptmann, it will be observed, regards all these dissonant chords, including all the chords of the Seventh, as having a " double root," a dual origin. Hauptmann has certainly reason and logic on his side, and his position here is much more defensible than that of theorists who derive " diatonic discords," augmented and diminished triads, and so forth, from one and the same generator. Rameau, in effect, also gives to the chord of the Dominant Seventh and the chord of the Added Sixth a twofold origin, when he explains the first chord as formed by the addition of the Subdominant to the Dominant harmony, and the second by the addition of the Fifth of the Dominant to the Subdominant harmony.

¹ *Harmony and Metre*, " Resolution of Dissonance."

² *Ibid.*, " The Augmented Triad."

THE CHROMATIC SCALE.

Hauptmann's theory as to the origin of the chromatic scale does not differ essentially from that of Rameau. Each chromatically raised note he considers to be the Third of a Dominant. "A note raised chromatically," he says, "can, in the first instance, only have the meaning of the Third of a Dominant, that is, the leading note of a major or a minor key, which forms a close with the note next above it."¹ But Hauptmann also distinguishes the *ascending* chromatic scale with *chromatically lowered* degrees as :—C-D \flat -d-E \flat -e-F-f \sharp -G-a \flat -a-B \flat -b-C. In this scale "the Tonic elements C and G are transposed from ground-tone and Fifth into Third meaning, and appear themselves as leading-notes."² He further states :—"It is an erroneous opinion that chromatically raised degrees belong exclusively to ascending motion, and chromatically lowered degrees to descending."

Most remarkable is the resuscitation by Hauptmann of the "chord by supposition." This is the chord of the Ninth. We read :—"In the passage G-b-D-a : G-b-D-g the lowest note of the first chord is entirely neglected in the resolution, and the dissonance b-a is alone taken into account, for which the resolution b-G is given."³ That is, Hauptmann, like Rameau, considers the lowest note of the chord G-b-D-a to be a "supernumerary sound." One would imagine, on the contrary, that it is just this sound which determines the resolution of a on G. Hauptmann does not consider the chords of the Eleventh and Thirteenth to be real harmonic formations.

THE MINOR HARMONY.

Hauptmann's explanation of the minor harmony does not differ essentially from that of Rameau ; that is, he considers it to be an inverted major harmony. When a triumvirate of theorists such as Rameau, Tartini, and Hauptmann express the same opinion respecting the nature of the minor harmony, the correctness of such an opinion becomes more than a mere probability. But it is one thing to express an opinion, and another thing to demonstrate its correctness.

¹ *Harmony and Metre*, "Passing-notes." ² *Ibid.*

³ *Ibid.*, "Chords of the Ninth, Eleventh, and Thirteenth."

Hauptmann remarks:—"The determinations of the intervals of the triad have been hitherto taken as starting from a positive unity, or ground-tone, to which the Fifth and Third have been referred. They may also be thought of in an opposite sense. If the first may be expressed by saying that a note *has* a Fifth and Third, the opposite meaning will lie in a note *being* Fifth and Third. *Having* is an active state; *being* is a passive one. . . . In the major triad C-e-G, C-G is Fifth, and C-e, Third; in the minor triad a-C-e, a-e, is Fifth, and C-e, Third. But in the latter the common element for both determinations is contained in the note of the *Fifth*; therefore that note, being doubly determined, may be regarded as doubly determining, in a negative sense; or as the negative unity of the chord. Therefore the symbol II-III-I seems not unsuitable for the minor chord."¹

After referring to the fact that the minor triad appears in the harmonic series, corresponding to the numbers 10 : 12 : 15, he proceeds:—"The minor triad, as an inverted major triad, must, in its meaning of being considered to originate from a negative unity, consist of a construction backwards.

I — II

Referred to the unity C, the major triad is C—e—G : the

I—III

minor triad of the same unity C, that is, as Fifth

II — I

determining ground-tone and Third, is F—a^b—C, which is

III—I

F—a^b—C."²

the same as if we put I — II

I—III

Hauptmann, then, is of opinion that $\begin{smallmatrix} F-C \\ II-I \end{smallmatrix}$ and $\begin{smallmatrix} F-C \\ I-II \end{smallmatrix}$ mean the same thing. If the minor harmony must be understood to "consist of a construction backwards," then its correct expression is $\begin{smallmatrix} F-a^b-C \\ II-III-I \end{smallmatrix}$. But Hauptmann, strangely enough, is not satisfied with this expression; although there is nothing in the Hegelian system of metaphysics which would forbid the determination of intervals downwards as well as upwards. The real determination of the minor harmony he considers

¹ *Harmony and Metre*, "Minor Triad."

² *Ibid.*

F— \flat —C
 to be I — II. That is, he relates the question to the
 I—III

acoustical determination of intervals. In such a case the minor harmony appears as a “duality,” that is, it has a two-fold origin. C is Fifth of F, and Third of \flat .

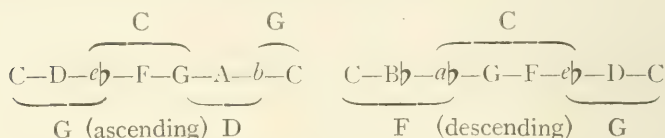
But, urges Hauptmann, the intervals of the minor harmony may be thought of as being negatively determined. From this point of view, the minor harmony appears as a unity. But exactly what importance or significance the negative determination of intervals possesses for the theory of harmony Hauptmann does not make sufficiently clear. When he states that an interval is negatively determined downwards, he merely means it is positively determined upwards; and when he remarks that the minor harmony originates from a “negative unity,” he merely repeats his explanation of this harmony as being positively determined upwards from a “double root.” It may be that the minor harmony, understood as a harmonic unity, must be regarded as originating downwards; the whole difficulty is to explain how such a construction can possibly arise.

Hauptmann’s difficulties in connection with the Minor key-system, are, as may be imagined, much greater than those in connection with the Major. Like Rameau, he explained the major key-system as determined by a “triad of triads.” Like Rameau, also, he found three triads insufficient for his purpose, and was obliged to utilise other triads. But while Rameau had to search outside the key-system, Hauptmann discovered within the key-system itself the triads of which he stood in need, namely, those on the Mediant and Submediant. Hauptmann, of course, was aware that it was necessary to find some explanation of these triads. But now, in the minor key-system, we find at the very outset that the principal sounds of the Tonic, Dominant, and Subdominant furnish us, not with three triads only, but five. For on the Dominant, and likewise on the Subdominant, there occurs not only a minor but also a major

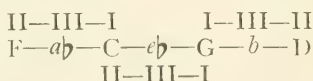
harmony : thus :—

$\overbrace{\text{F} - \text{a}\flat - \text{C}}$	$\text{---} \text{---} \text{---} \overbrace{\text{G} - \text{b}\flat - \text{D}}$
$\underbrace{\text{F} - \text{a}\flat - \text{C}} \text{---} \underbrace{\text{e}\flat - \text{G} - \text{b}\flat - \text{D}}$	

These five triads, however, are not sufficient : other two are necessary in order to explain the melodic succession of the sounds of the scale. In the ascending scale, " the connecting link between G and *b* can only be determined by the Fifth of the Dominant, D, whose Fifth A provides the passage from G to *b*." But this A, Hauptmann tells us, " lies outside of the system." In the descending scale, the passage from the Octave C to the minor Sixth *ab* can only be effected by means of a triad whose fundamental note also lies outside of the key-system, namely, B*♭*-*d*-F. " While in ascending the Fifth of the dominant had to become Root, in descending the Root of the subdominant must become Fifth." The explanation of the ascending and descending forms of the minor scale is therefore as follows :—



Hauptmann is unable to make up his mind as to which note of the minor harmony should be described as the fundamental note. He frequently speaks of the lowest note of the minor harmony as the " ground-tone " or fundamental note. Nevertheless, he represents the minor key-system as follows :—



Here we find the Dominant G, represented as I or ground-tone not only of the Dominant major triad G-*b*-D, but also of the Tonic minor triad C-*e♭*-G. The Dominant G is the " ground-tone " of both triads. If we take G as Tonic the key-system appears to be left without a Dominant ; and if G be taken as Dominant, it is left without a Tonic ; that is, unless we regard G as being at one and the same time Dominant *and* Tonic.

CHORD RELATIONSHIP AND CHORD-SUCCESSION.

Hauptmann's theory of chord succession differs from that of Rameau. Rameau relates chord succession to the progression of the Fundamental Bass. Hauptmann, on the other hand, considers that chord succession can be explained only as a linking together of successive harmonies by means of sounds which they possess in common. It is this common element between successive chords which renders chord succession intelligible. Hauptmann says :—"The succession of two triads is only intelligible in so far as both can be referred to a common element which changes meaning during the passage."¹ The succession C-e-G—b-D/F must therefore be understood thus :—C—e—G

e—G—b

b—D/F, and similarly in

the case of other disjunct triads.

So also the succession from the Tonic chord to that of the Dominant Seventh must be understood as :—C-e-G. . . . b-e-G. . . . b-D-G. . . . b-D-F. . . . = b-D-F-G; and from the Tonic chord to that of the Supertonic Seventh, as C-e-G . . . C-e-a . . . C-F-a . . . D-F-a = C-D-F-a.

Hauptmann, then, considers that a Subdominant-Dominant harmonic succession can only be effected through the mediation of one or more linking triads; that is, he is unable to find any explanation of the *immediate* succession of both Dominants, a succession which continually occurs in harmony. But even with regard to the succession Tonic-Dominant and Tonic-Subdominant Hauptmann remarks :—"The passage from C-e-G to F-a-C, which leads to the position C-F-a, is a compounded one, and consists of the progressions C-e-G C-e-a. . . . C-F-a. . . . Similarly with the succession from C-e-G to G-b-D, which is compounded of the successions C-e-G. . . . b-e-G. . . . b-D-G." It follows therefore that the reverse progression, namely, from Dominant to Tonic harmony, should be understood in a similar way, as :—G-b-D. . . . G-b-e. . . . G-C-e. If it be true that it is community of sounds which determines chord relationship,

¹ *Harmony and Metre*, "Chord-Succession."

then, beyond all question, those chords which possess two sounds in common are more closely related than those which possess only one sound in common. The succession G-b-D G-b-e. . . . G-C-e, must be regarded as being more "directly intelligible" than the succession G-b-D. . . . G-C-e. This is the essence of the Hauptmann theory of chord succession. Unfortunately, it conflicts with the facts as manifested in the Perfect Cadence, and therefore breaks down at a crucial point. The essence of this Cadence lies in the direct and immediate succession of Dominant-Tonic harmonies, which furnishes us with the most "directly intelligible" of all harmonic successions.

H. L. F. HELMHOLTZ.—"SENSATIONS OF TONE."

Ten years after the publication of Hauptmann's *Harmonik und Metrik* there appeared the well-known work by Professor H. L. F. Helmholtz—*The Sensations of Tone as a Physiological Basis for the Theory of Music* (*Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik*, 1863). Helmholtz's work is, in many respects, one of the most important of its kind, and not least in the respect that its author was one of the most distinguished physicists of his time, who brought to the consideration of the theory of music and of harmony not only considerable musical insight, but also a trained scientific judgment and accurate scientific methods.

As is known, Helmholtz in the first part of his work investigates in the most complete way the nature of musical sound and of sound in general, of the Composition of Vibrations, of Sympathetic Resonance, of Upper Partial Tones, Quality of Musical Tones, etc.; in Part II. he treats of Combinational Tones, of Beats, of the relationship of both to the Phenomena of Consonance and Dissonance, of the Relative Harmoniousness of Intervals and Chords; while in Part III., with which we are most immediately concerned, he treats more specifically of the theory of harmony, and applies the results of his previous observations to the consideration of the origin and development of scales, of key-systems, chord relationship and chord succession, concords and discords.

MAJOR HARMONY.

The explanation of the major harmony advanced by Helmholtz does not differ essentially from that of Rameau. As we have seen, Helmholtz agrees with Rameau that the natural relations which may be observed to exist in the resonance of the sonorous body constitute the proper basis of the theory of harmony. In the major harmony, he states, all the sounds of which it is composed are constituents of the compound "*klang*" of the fundamental sound. This sound Rameau has quite properly described as the *fundamental bass* of the harmony.

MINOR HARMONY AND CHORD OF THE "ADDED SIXTH."

As for the minor harmony, Helmholtz considers this to have a two-fold origin. Helmholtz is generally supposed to have been the first to advance this explanation of the minor harmony. We have seen, however, that this is by no means the case. It was first proposed by Rameau, adopted by Serre and D'Alembert, and later, apparently independently, advanced by Hauptmann. It is important to note that Helmholtz discovers in the nature of the minor harmony a proof of the correctness of Rameau's theory of "double employment."

He says: "In the minor chord $c-\bar{e}b-g$, the g is a constituent of the compound tone of both c and $\bar{e}b$. Neither $\bar{e}b$ nor c occurs in either of the other two compound tones. Hence it is clear that g at least is a dependent tone. But on the other hand this minor chord can be regarded either as a compound tone of c with an added $\bar{e}b$, or as a compound tone of $\bar{e}b$ with an added c . Both views are entertained at different times, but the first is the more usual. If we regard the chord as the compound tone of c , we find g for its third partial tone, while the foreign tone $\bar{e}b$ occupies the place of the weak third partial e . But if we regard the chord as a compound tone of $\bar{e}b$, although the weak fifth partial g would be properly represented, the stronger third partial, which ought to be b , is replaced by the foreign tone c .

Hence, in modern music, we usually find the minor chord $c-\bar{b}-g$ treated as if its root or fundamental bass were c , so that the chord appears as a somewhat altered and obscured compound tone of c . But the chord also occurs in the position $\bar{c}b-g-c$ (or better $\bar{c}b-g-\bar{c}$), even in the key of Bb major, as a substitute for the chord of the subdominant $\bar{c}b$. Rameau then calls it the chord of the major (added) sixth, and, more correctly than most modern theorists, regards $\bar{c}b$ as its Fundamental Bass.”¹

This is an extraordinary pronouncement from so eminent a theorist and scientist as Helmholtz. He first explains the minor harmony as a duality; it has two roots: g is Fifth of c and major Third of $\bar{c}b$. While the major harmony is a single *klang*, the minor harmony is a dual *klang*. Helmholtz, however, is aware of the objections which may be urged against this view. He therefore invites us to consider the minor harmony $c-\bar{c}b-g$ as a “somewhat altered” major harmony. The minor harmony, then, we ought to regard as a major harmony somewhat out of tune, the “out-of-tuneness” being of the extent of a chromatic semitone 24 : 25, which is the difference between e and $e\flat$!

Further, Helmholtz quite mistakes the manner in which Rameau formulated his theory of “double employment.” This device of Rameau had nothing to do with any supposed ambiguity of the minor harmony. Rameau did not consider the two chords $d-f-a-c$ and $f-a-c-d$ to originate with a minor harmony at all, but with a major one. That is, he did not regard the fundamental harmony of the chord $d-f-a-c$ to be the chord $d-f-a$, nor did he consider that the fundamental harmony of the chord $f-a-c-d$ was $f-a-d$ (which is merely the inversion of $d-f-a$). In both cases Rameau expressly states that the fundamental harmony is $f-a-c$, and forms the chord $d-f-a-c$ by adding d below the chord $f-a-c$. This note d , he expressly states, is the dissonant note of the chord $d-f-a-c$.

But Helmholtz, who is an apostle of just intonation, was quite well aware that the triad on the supertonic ($d-f-a$ in C major, or $c-\bar{c}b-g$ in Bb major) is not a minor consonant triad at all, but a diminished one. His own words are:—
“The chord $d-f-\bar{a}$ [Helmholtz’s notation] which in the usual

¹ *Sensations of Tone*, Pt. III., Ch. 15.

musical notation is not distinguished from the minor triad $d-f-a$, and may hence be called the *false minor triad* is, as Hauptmann has correctly shown, dissonant, and on justly intoned instruments is very decidedly dissonant.”¹ According to just intonation, the minor triad cannot occur on the supertonic of a major key. Helmholtz, not without reason, dwells with admiration on Rameau’s fine tonal sense. It was Rameau’s fine tonal sense which guided him in his treatment of the chord $d-f-a-c$, where, between d and a , there is not a perfect Fifth, but a diminished one.

ORIGIN OF DISSONANT CHORDS.

Helmholtz’s views on the formation of dissonant chords, although not original, are nevertheless remarkable enough to deserve mention. Chords of the Seventh, consisting of a major triad with major Seventh, or of a minor triad with minor Seventh, he considers like Hauptmann to be formed from the union of two triads. The chord of the Dominant Seventh, however, has a different origin. Of this chord he remarks:—“We must observe that the minor seventh $g-f$ approaches so nearly to the ratio 4:7, which would be almost exactly represented by $g-f$, that f may in any case pass as the seventh partial tone of the compound tone G Hence, although the chord of the Dominant Seventh is dissonant, its dissonant tone so nearly corresponds to the corresponding partial tone in the compound tone of the dominant, that the whole chord may be very well regarded as a representative of that compound tone. For this reason, doubtless, the seventh of this chord has been set free from many obligations in the progression of parts to which dissonant sevenths are otherwise subjected. Thus it is allowed to be introduced freely, without preparation, which is not the case for the other sevenths. . . . The chord of the Dominant Seventh consequently plays the second most important part in modern music, standing next to the Tonic. It exactly defines the key, more exactly than the simple triad $g-b-d$, or the diminished triad $b-d-f$. As a dissonant chord

¹ *Sensations of Tone*, Pt. III., Ch. 17.

it urgently requires to be resolved on the Tonic chord. . . . This chord appears to have been discovered by Monteverde." ¹

Once more we light upon the theory of the "natural chord of the Seventh," already mentioned in connection with Sorge and Fétis. It is remarkable that Helmholtz, after explaining the consonant minor harmony as the result of a dual *klang*, should now ask us to consider the dissonant chord of the Dominant Seventh as the result of one and the same *klang*. Further, the most characteristic discord of the key-system is now a quasi-consonant chord. Speaking of the "natural" Seventh earlier in his work, Helmholtz had stated that "the sub-minor Seventh 4 : 7 is very often more harmonious than the minor Sixth 5 : 8 ; in fact, it is always so when the third partial tone of the note is strong as compared with the second." ²

But although Helmholtz makes of the chord of the Dominant Seventh a self-sufficing combination, existing in and for itself, he nevertheless thinks that it "urgently requires to be resolved."

He is also of opinion that it "exactly defines the key," notwithstanding that all its sounds are the result of a single *klang*. But this can only happen if the Seventh of the chord, which is dissonant with the Dominant, but consonant with the Tonic, be regarded as the Subdominant itself, as Rameau asserted it to be. If on the other hand the Seventh be regarded as a constituent of the compound tone of the Dominant, we get a note which brings about quite new relationships, for it bears a quasi-consonant relationship with the Dominant, but is dissonant, decidedly dissonant, with the Tonic.

It appears to have escaped the attention of Helmholtz that the ratio of the augmented Sixth $f-d\sharp$ (f =fourth degree of the scale of C major ; $d\sharp$ =chromatically raised second degree) approximates more nearly to the ratio of the "natural" Seventh than does the minor seventh $g-f=9 : 16$. Here are the respective ratios:—

Natural Seventh 4 : 7	=	128 : 224
Augmented Sixth	=	128 : 225
Minor Seventh (9 : 16)	=	126 : 224

¹ *Sensations of Tone*, Pt. III., Ch. 17.

² *Ibid.*, Pt. II., Ch. 10.

While the difference between the Augmented Sixth and natural Seventh is represented by the extremely small interval $224 : 225$, the difference between the minor Seventh $g-f$ and the natural Seventh is that of the much larger interval $63 : 64$, an interval larger than the syntonic comma ($80 : 81$). It would be much more reasonable, therefore, to identify the chord of the Augmented Sixth with the natural Seventh, rather than with the chord of the Dominant Seventh, as does Helmholtz. There is of course no more reason for describing the seventh partial tone as "a Seventh" than there would be for describing the fifth degree of the diatonic scale as "a Third" because it is the third partial tone of the Tonic.

The chord of the Dominant Major Ninth is explained by Helmholtz in similar fashion. In the chord $b-d-f-a$ we must observe, he remarks, "that the two tones f and a approach very closely to the two next partial tones of the compound tone of G . Hence the chord of the Ninth $g-b-d-f-a$ may represent the compound tone of the dominant g , provided that the similarity be kept clear by the position of the tones; g being the lowest and a the highest. . . . This seems to me to be the simple reason why musicians find it desirable to make a the highest tone in the chord $b-d-f-a$." ¹

Of the chord of the Diminished Seventh $b-d-f-a\flat$, he states that "it contains no note which belongs to the compound tone of any other note in the chord, but the three notes $b-d-f$ may be regarded as belonging to the compound tone of g , so that it also presents the appearance of a chord of the Ninth in the form $g-b-d-f-a\flat$. It therefore imperfectly represents the compound tone of the dominant, with an intruded $a\flat$." ²

Helmholtz does not distinguish a chord of the Dominant Eleventh as $g-b-d-f-a-c$, nor a chord of the Dominant Thirteenth as $g-b-d-f-a-c-e$. The c in these chords differs from the real Tonic by nearly a quarter tone ($32 : 33$). But apart from this fact there is an obvious difficulty in explaining c , the Tonic, as having its source in the compound tone of g , the Dominant.

¹ *Sensations of Tone*, Pt. III., Ch. 17.

² *Ibid.*

CHORD RELATIONSHIP AND SUCCESSION.

Helmholtz identifies himself also with Hauptmann's theory of chord succession; he holds, with Hauptmann, that chord succession is intelligible by virtue of a common element existing between successive chords. He says:—"Just as the older homophonic music required the notes of a melody to be linked together, so modern music endeavours to link together the series of chords occurring in a web of harmony." Again, "When disconnected triads would come together it is frequently advantageous to transform them into chords of the Seventh, and thus create a bond between them." Thus, in place of *f-a-c—g-b-d*, we may substitute *f-a-c-d—g-b-d*. Helmholtz is not more in a position than Hauptmann to explain the immediate succession of both Dominants.

Although Helmholtz, in many difficult questions relating to the theory of harmony, is too often content merely to offer hints and suggestions rather than venture on any positive statement, we nevertheless find the following:—"When two chords have two notes in common they are more closely related than when they have only one note in common. Thus *c-c-g* and *a-c-c* are more closely related than *c-c-g* and *g-b-d*."¹ This is the logical outcome of Helmholtz's theory of chord succession, as it is of Hauptmann's. It follows, and must follow, that a Dominant-Tonic succession of harmonies, as in the Perfect Cadence, is less "directly intelligible" than a Dominant-Mediant-Tonic succession.

TONALITY.

Notwithstanding the deservedly high position as a musical theorist which Helmholtz occupies in the esteem of musicians, it would nevertheless be somewhat difficult to state exactly what original contribution he has made to the theory of harmony. Dr. Riemann is of opinion that Helmholtz's greatest contribution to the science of harmony is his principle of "klang-representation" (*Klangvertretung*). "Helmholtz," he remarks, "has opened up quite new perspectives by his principle of klang-representation." This honour however belongs not to Helmholtz, but, as we have seen, to Rameau.²

¹ *Sensations of Tone*, Pt. III., Ch. 15.

² See p. 183.

Besides, Hauptmann had already stated that every note in our modern harmonic system of music must be regarded as the Fundamental note, Third, or Fifth of a triad. It is much more in the principle of *Tonality* that Helmholtz discovers the ultimate explanation of the art of music, melodic or harmonic. He explains "as the fundamental principle for the development of the European tonal system," that "*the whole mass of tones and the connection of harmonies must stand in a close and always distinctly perceptible relationship to some arbitrarily selected tonic, and that the mass of tone which forms the whole composition must be developed from this Tonic, and must finally return to it.*" [Italics by Helmholtz.] The ancient world developed this principle in homophonic music; the modern world in harmonic music."¹

It may at once be said that this principle of *Tonality*, as enunciated by Helmholtz, represents a distinct advance on that of Fétis. It has frequently been thought to mark a fresh and important stage in the development of the theory of harmony. It has even been considered, somewhat too hastily perhaps, to furnish an adequate solution of some of the most obscure facts of harmonic science. But the principle on which Helmholtz here lays stress does not mark a new conception. It was enunciated quite clearly by Rameau. It forms the root idea of his whole work as a theorist. It is the root idea of the numerous theorists who since Rameau's time have regarded the harmonic series as the principle of chord generation. It was Rameau who, for the first time, stated in his *Génération Harmonique* that all harmony is developed from the Tonic, and that the Tonic is the centre of the harmonic system.

Helmholtz's enunciation of the principle of *Tonality*, in itself admirable, is therefore little more than a statement of the problems which the theory of harmony has to face. It was to their solution that Rameau addressed himself in his numerous works on harmony. We saw that the principal difficulty was to determine exactly *how* the "mass of tone" is "developed from" the tonic.

Helmholtz's views as to the origin of early scales have

¹ *Sensations of Tone*, Pt. III., Ch. 13.

already been referred to.¹ In these scales Helmholtz is of opinion that each degree of the scale, with the exception of the Tonic itself, must have been selected on the principle of its relationship to the Tonic. It is thus, according to Helmholtz, that the sounds of the scale have been "developed from" the Tonic. In the case of the Greek tetrachord $\widehat{e-f-g-a}$, we must, then, believe that the "relationship" between g and a ($8:9$) and between f and a , which was an interval of the proportion $64:81$, was "distinctly perceptible" to the Greeks. It was not, however, the "relationship" between these sounds, but the want of relationship, which appears to have most impressed Greek musicians and writers on music.

The value of Helmholtz's theory as to the origin of early scales, and as to the manner in which the sounds of the scale were developed from an "arbitrarily selected Tonic" on the principle of "close and distinctly perceptible relationship" to this Tonic, may be judged from the following frank statement:—"Pythagoras constructed the complete diatonic scale from the following series of Fifths: F-C-G-D-A-E-B. In his diatonic scale there are but two kinds of small intervals, the whole-tone, $8:9$, and the *Limma*, 243-256. In this series, if C be taken as Tonic, A would be related to the Tonic in the *third degree*, E in the *fourth*, and B in the *fifth* . . . but neither singer nor hearer could possibly discover in passing from C to E that the latter is the fourth from the former in the series of Fifths. Even in a relation of the second degree through Fifths, as of C to D, it is doubtful whether a hearer can discover the relation of the two tones."¹ In fact, in this scale, no matter which sound be "arbitrarily selected" as Tonic, not more than two sounds, if we exclude the Octave, namely, the Fourth and the Fifth, will be found to bear "a distinctly perceptible relationship to the Tonic." If, as is most natural, we select F as Tonic, seeing that it forms the starting point of the series of Fifths, only one sound, C, the Fifth above, bears such "a distinctly perceptible relationship."

Helmholtz, therefore, in treating of early scales, prefers to give them "natural" or just rather than Pythagorean

¹ See pp. 205-207.

² *Sensations of Tone*, Pt. III., Ch. 14.

Thirds and Sixths. But that such scales cannot represent "early scales" is evident from his own remark, which he makes in another portion of his work, that "all antiquity refused to accept Thirds as consonances . . . the proper intonation of Thirds was not discovered in early times, and the Pythagorean Third, with its ratio of 64:81, was looked upon as the normal form till towards the close of the Middle Ages."¹

It is just the use made in modern music of these "natural" Thirds which constitutes a fundamental difference between our modern scales and early scales. The introduction of these "natural consonances," as has frequently been insisted upon throughout the course of this work, marks an event of the greatest theoretical importance. It led directly to the decay of the old scales, and made possible our modern tonal system. In referring to this tremendous change, however, Helmholtz is content to repeat the legend so sedulously propagated by Fétis concerning Monteverde's epoch-making introduction and employment of the chord of the Dominant Seventh.

Helmholtz is not more successful in his attempts to show how, in our modern scales, the sounds have been "developed from" an arbitrarily selected Tonic. He is of opinion that all the sounds of the scale *may* be regarded as constituents of the harmonies of the three sounds, Tonic, Dominant, and Subdominant. But he is by no means prepared to allow that these are the only or ultimate determinations of the sounds of the scale. For example, *a*, the sixth degree of the scale of C major, may be determined in three different ways:—(1) as major Sixth of the Tonic; (2) as major Third of the Subdominant; (3) as perfect Fourth of the Mediant. Again *b*, the seventh degree, may be determined as (1) major Seventh of the Tonic (!); (2) Third of the Dominant; (3) perfect Fifth of the Mediant. In the same way, Helmholtz might have proceeded to show that the Dominant, instead of having a perfectly definite and fixed relationship to the Tonic, in which, as Rameau stated, it has its one and only source, has other determinations; for example, as perfect Fourth of the Supertonic; as minor Third of the Mediant; as major Second of the Subdominant,

¹ *Sensations of Tone*, Pt. II., Ch. 10.

or minor Sixth of the leading-note, and so on. Only how all this enables us to understand better the nature and origin of our tonal system it is somewhat difficult to imagine. As for the minor scale, or rather scales, matters are even worse.

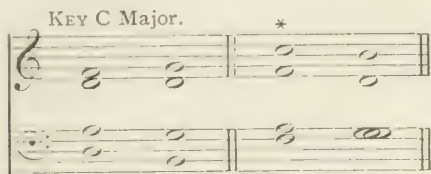
With regard to chords, consonant and dissonant, which belong to the key-system, how many of these did Helmholtz really consider he had succeeded in proving to be developed from an arbitrarily selected Tonic? Like other theorists before and after him, Helmholtz has little difficulty in pointing to the fact that all the sounds of the major harmony, as that on the Tonic of a major key, are constituents of the compound tone of the Tonic. But what of the other chords; for example, that on the next degree of the major scale: the diminished triad on the Supertonic, as *d-f-a*? Whence is this triad derived? We may, of course, explain *d* as the major Second of the Tonic *C*; *f* as its perfect Fourth, and *a* as its major Sixth, but this does not help matters greatly. In the case of the minor harmony, as *a-c-e*, we have seen that Helmholtz considers *c* to be a "foreign sound"; such a sound, therefore, cannot properly be said to be "developed from" the Tonic *a*.

Of the Subdominant, the despair of so many theorists, Helmholtz treats thus:—"When we pass from *C-E-G* to *G-B-D*, we use a compound tone, *G*, which is already contained in the first chord. . . . It is quite different with the passage from *C-E-G* to *F-A-c*. The compound tone *F* is not prepared in the first chord, and it has therefore to be discovered and struck. The justification of this passage, then, is not complete on the ground of close relationship between the chords, until it is felt that the chord of *F* contains no tones which are not closely related to the Tonic *C*."¹ Helmholtz evidently considers this to be an adequate explanation of the Subdominant.

Helmholtz is even less successful, as might be expected, in his attempt to show how the principle of Tonality determines chord succession. He cannot explain on the principle of the "relationship of the mass of tones" to the Tonic,

¹ *Sensations of Tone*, Pt. III., Ch. 15.

some of the simplest of harmonic successions, as, for example :—



The sounds which form the combination at * may be explained thus :—*f* is Fourth of the Tonic, while *a* is its major Sixth ; *c* is the Tonic itself. But this does not help us to understand the progression of this chord to the disconnected triad *g-b-d*. But, as we have seen, Helmholtz brings forward quite a different theory of chord successions : those chords tend to succeed one another which are related by means of one or more common notes.

THEORY OF CONSONANCE AND DISSONANCE.

Helmholtz's theory of Consonance and Dissonance, already referred to, has been subjected to so much examination and criticism in other works that it is unnecessary to enter into the question here. Dr. Carl Stumpf has shown¹ that it is possible to construct by means of simple tones most discordant combinations of sounds, which, nevertheless, produce no beats. He has also pointed to the fact that rapid intermittent sounds do not necessarily always produce an unpleasant or irritating effect on the ear, and has instanced as proofs of his contention the *tremolo* of the stringed instruments of the orchestra, and the *vibrato* and other devices resorted to by both vocalists and instrumentalists in order to obtain a rapid intermittence of the tone. He has remarked also that Helmholtz distinguishes varying degrees of dissonance for the same dissonant interval, according to the position it occupies in the scale of sounds. For example, the semitone

¹ *Tonpsychologie*, 2 vols., 1883 and 1890, and *Konsonanz und Dissonanz*, 1898.

$b'c''$, which produces 33 beats in a second, is pronounced by Helmholtz to be an extremely harsh dissonance; its dissonant effect is, however, considerably modified by its being taken an octave higher, in the position $b''c'''$, with 66 beats; while in the position $b'''c''''$, two octaves higher, which produces 132 beats, the roughness of the interval becomes very sensibly diminished. This is owing to the increased rapidity of the beats. "The beats of a whole-tone," remarks Helmholtz, "which in low positions are very distinct and powerful, are scarcely audible at the upper limit of the thrice-accented Octave."¹ Stumpf, however, is unable to account for the phenomenon of Consonance on psychological grounds; it must have, he thinks, a physiological explanation.²

The considerations advanced by Stumpf cannot by any means be held to justify the entire rejection of Helmholtz's theory of consonance. At the same time such a theory is plainly inadequate. The explanation of consonance as arising from the absence, or comparative absence, of beats is a negative rather than a positive one. But, urges Helmholtz, such an absence of beats results in a certain smoothness of effect; and smoothness is an æsthetical quality. The difference of effect, however, produced on the mind by the major, as compared with the minor harmony, is not accounted for by describing the major harmony as smoother in its effect than the minor. The explanation given by Helmholtz of the sensation produced by a single musical sound does not differ essentially from his explanation of consonance:—"A musical tone," he states, "strikes the ear as a perfectly undisturbed, uniform sound which remains unaltered as long as it exists." This is the physical explanation of the sensation of musical sound. But, as Helmholtz shows, the flow of sound resulting from perfectly simple tones is much smoother, more uniform than that resulting from musical sounds with well developed

¹ *Sensations of Tone*, Pt. II., Ch. 8.

² "Die Ursache der Verschmelzung ist eine physiologische. . . . Dafür sprach ohnedies schon von vornherein der Umstand, dass dieselbe eine Tatsache der Empfindung, ein den gleichzeitigen Tonqualitäten immanentes Verhältnis, und von der Uebung in individuellen Leben unabhängig ist. *Empfindungsverhältnisse sind aber, wie Empfindungen selbst, nicht auf weiter zurückliegende psychische Ursachen sondern nur auf physische zurückzuführen.*"—*Tonpsychologie*, Vol. II., p. 211.

upper partial tones, one reason being that beats arise between the upper partial tones themselves. It would appear then that such composite musical sounds must be greatly inferior in respect of the musical sensation they produce in the ear as compared with simple tones. The opposite, however, is the case. Simple tones are dull, poor, and comparatively devoid of musical charm. On the other hand, "musical tones which are accompanied by a moderately loud series of the lower upper partial tones, up to the sixth upper partial, are more harmonious and musical; compared with simple tones, they are rich and splendid."¹

ÖTTINGEN AND THE ORIGIN OF THE MINOR HARMONY.

Three years after the appearance of Helmholtz's work, A. von Öttingen (*Harmoniesystem in dualer Entwicklung*, 1866) made a severe attack on Helmholtz's theory of consonance and dissonance. It was especially against the latter's inadequate treatment of the minor harmony that Öttingen's criticism was directed. Öttingen was not slow to point out the inconsistency of Helmholtz in admitting *foreign* and *added* sounds in a *klang*. He maintains that consonance and dissonance do not find a completely adequate explanation in Helmholtz's theory of the coincidence or non-coincidence of upper partial tones. He argues that the clashing of upper partial tones is as marked in the major, as in the minor harmony (a):—

(a) Major. (b) Minor.

Notes above staff: b_3 , g_3 .
Notes below staff: C., A_2 .

The analogy between both harmonies, in which the minor is considered as the reverse of the major harmony, is also

¹ *Sensations of Tone*, Pt. I., Ch. 5.

shown by the fact that the two strongest secondary tones, the common partial tone of the major (*phonic overtone*), and the chief combination tone of the minor harmony (the *tonic ground-tone*) occupy a like position in respect of both chords (*b*).

In the major harmony, all the sounds of which it is composed find their unity (*Einheitbeziehung*) or central point in the fundamental or ground-tone (*tonic ground-tone*); in the minor harmony, on the other hand, the element of union is found in the first partial tone common to all the three sounds of the harmony:—



Considered in a major sense, that is, in an upward direction, the minor harmony is in reality dissonant; in a downward, sense, it is consonant. The major harmony, on the other hand, considered in the first aspect, is consonant, and in the second, dissonant.

Whether or not Öttingen's conclusions are to be accepted as finally determining this difficult question of the minor harmony, they at least deserve the fullest consideration. It should be observed that Öttingen is very far from establishing that a complete analogy exists between the two harmonies. For example, the major harmony is consonant, not only in an *upward* sense, in respect of its upper partials, but in a *downward* sense, in respect of its combination tones, while the minor harmony is consonant neither with respect to its combination tones nor its upper partials. Further, Öttingen cannot well maintain that there is any real analogy between the "tonic ground-tone" of the major and what he describes as the "phonic overtone" of the minor harmony. He cannot maintain that, while *c* is the fundamental note of the major harmony *c-e-g*, *g* is the fundamental note of the minor harmony, *c-e♭-g*. This *g* of the minor harmony is a determined note, and is shown by Öttingen himself to be the Fifth of *c*. So that between *c-g* of the major harmony,

and *c-g* of the minor harmony, there is absolutely no difference; *c* is fundamental and *g* is Fifth in each case. When, then, Öttingen shows us that in the minor harmony *c-e♭-g*, *g* is Fifth of *c*, and Third of *e♭*, his position does not appear to be materially different from that of Helmholtz, that is, he considers the minor harmony to arise from two sources. At the same time Öttingen makes it increasingly evident that the only sense in which the minor harmony can be regarded as a harmonic unity is that of an inverted major harmony. But how such an inversion is to be brought about, how it is possible for the ear to conceive a chord, which is doubly determined, as a harmonic unity, still remains a mystery.

DR. H. RIEMANN AND THE "UNDERTONE-SERIES."

In his attack on Helmholtz's theory, Öttingen found supporters in *H. Lotze* (*Geschichte der Aesthetik in Deutschland*, 1868); *Dr. Stumpf*, already mentioned; *Hostinsky* (*Die Lehre von den musikalischen Klängen*, 1879), and *Dr. Riemann* (*Musikalische Logik*, 1873; *Musikalische Syntaxis* 1877; *Die Natur der Harmonik*, 1882; *Geschichte der Musiktheorie*, 1898; *Musiklexikon*, etc.).

Dr. Riemann is of opinion that Öttingen has given to Helmholtz's (*Rameau's*) conception of the principle of "klang-representation" an unexampled reach, in that he has rendered it possible to consider not only the major, but the minor harmony as a real "klang," represented by a single sound.¹ The great defect of Helmholtz's theory, Dr. Riemann remarks, is his failure to give an adequate explanation of consonance and dissonance, and especially of the consonance of the minor harmony. "The most controvertible chapter of Helmholtz's work is that treating of consonance and dissonance, which Helmholtz sought to explain on physiological grounds by means of differences of euphony or harmoniousness. He finds the cause of dissonance in beats. The major chord is more free from beats than any other chord, but the minor harmony is the obscuring (*Trübung*) of the physiological

¹ *Natur der Harmonik*, p. 29.

consonance. Beginning with the complete fusion of the sounds of a harmony, as represented by the first overtones, he gives an entire scale of chords, ranging from those of the most perfect degree of harmoniousness to the harshest dissonances, according to the measure of their beats, so that neither for the major and minor harmonies, nor for consonance and dissonance in general, is any distinction made except that of their varying degrees of euphony. This highly unsatisfactory result has given rise to the most violent opposition."¹

Dr. Riemann's explanation of the major harmony is essentially the same as that of Rameau. As for the minor harmony, he agrees with Öttingen that it must be regarded as determined in a downward direction, but is of opinion that the latter is not radical enough in his treatment of this harmony, in that he relates it to the series of overtones.² Nevertheless, he thinks that in his "*phonic*" explanation of the minor harmony, Öttingen has succeeded in giving "a physiological basis to a series of *undertones*, which for him is nothing but the series of those tones whereof a certain note selected as the starting point [a *Prime*] is the overtone," thus:—



In describing Öttingen's "*phonic*" overtone as a *Prime*, as he does here, Dr. Riemann of course knows that it is not actually such. It is an upper partial tone, a determined and dependent tone. But, he thinks, all that is necessary for the complete establishment of the minor harmony as the antithesis of the major, and the gaining of Öttingen's "*phonic* overtone" as a real *Prime*, is the scientific demonstration of the objective existence of a series of "*undertones*," in the same way as the ascending series of sounds, the overtones or upper partials, have been proved to exist objectively.

He says:—"As the consonance of the major chord is explained not only by means of the combination tones, but

¹ *Natur aer Harmonik*, pp., 23, 24.

² *Geschichte der Musiktheorie*, p. 499.

has its real foundation in the phenomenon of the overtones, so likewise for the completely adequate explanation of the minor consonance there is only necessary the opposite phenomenon of the undertones. Even if the existence of such a phenomenon did not admit of positive proof, nevertheless it must be remembered that the minor correlatives have a subjective existence, in that the major proportions may be measured downwards as well as upwards. I have already pointed out that the co-vibration of tones points the way towards the existence of a series of undertones; and the same may be affirmed of such acoustical phenomena as are furnished by the sounds produced by striking rods, metal discs, etc. (*Klirröne*). If one takes a vibrating tuning-fork and allows the prongs to touch quite lightly a resonance box, or if one sets in violent vibration a loosely held metal plate or disc, there may be heard, instead of the proper tones of the tuning-fork or plate, the lower octave or twelfth, even the lower 15th or 17th, as well as lower undertones. It is *even probable* that every tone has not merely a series of overtones, but also a series of undertones, of the same proportions, but gradually becoming more feeble as they recede from the prime tone, and being more difficult to distinguish, that is, to separate from the *klang* of the prime tone, than the overtones.”¹

It is impossible to enter here into any detailed examination of the arguments by which Dr. Riemann, in several of his works, attempts to prove that the series of undertones has a real objective existence. This however is really unnecessary, for it eventually turns out that Dr. Riemann is quite unable to furnish any scientific proof of the objective existence of undertones. In the article *Untertöne*, in his *Musiklexikon*, he remarks:—“The compiler of this dictionary has made repeated attempts to demonstrate the existence of undertones, corresponding to the overtone series; in his *Musikalische Logik* he has demonstrated their objective existence in the ear, and, from *various signs*, he *thinks himself justified* in believing in their objective existence. In his *Katechismus der Musikwissenschaft* (p. 79) he has shown finally by proof of a scientific character why, in spite of the commensurability of the vibration forms,

¹ *Natur der Harmonik*, pp. 21, 22.

a tone by summation of its vibrations *cannot produce the undertone series*, and that the question may thus be considered to be finally closed." The conclusion then is that Dr. Riemann has had little better ground for his theory of "undertones" than a somewhat too speculative imagination.

After this, one is not surprised to read in the *Natur der Harmonik*, a few pages after the author has given an account of his experiments with metal plates, and of tuning-forks placed wrongly on their resonators, the following statement:—"The principle of klang-representation is really not a matter for physics, nor for physiology, but for *psychology*. The minor as well as the major harmony is a 'fact of experience.'" It is therefore "a scientific fact, which forms as good a foundation on which to build as acoustical phenomena."¹

The foundation on which Dr. Riemann wishes to build is a somewhat insecure one, namely, that the Fifth of the minor harmony is the fundamental note of this harmony. It is surprising to find that he assumes as a fact what he is unable to prove, and that notwithstanding his failure to demonstrate the objective existence of an undertone series, he has nevertheless not been deterred from building up, in his work *Harmony Simplified*, a complete system on what he has himself admitted to be incapable of proof.

"TONAL FUNCTIONS OF CHORDS."

In *Harmony Simplified, or Theory of the Tonal Functions of Chords* (*Vereinfachte Harmonielehre*, 1893) we have a notable attempt, by one of the most eminent authorities on the subject of harmony of the present day, to arrive at a logical and consistent theory of harmony. Especially noteworthy is the fact that Dr. Riemann makes a return to some of the most essential of the principles enunciated by Rameau as well as by Hauptmann. There are but two harmonies, he states, which exist in and for themselves, that is, which are "directly intelligible," namely, the major and minor harmonies. The major harmony (*Overklang*) is determined in an upward direction, corresponding to the

¹ *Natur der Harmonik*, p. 29.

first six of the ascending series of overtones ; the minor harmony (*Underklang*) is determined in a downward direction, corresponding to the first six of the descending series of "undertones." In the first harmony, the lowest note of the chord is the fundamental note ; in the second, the highest note is the fundamental note.

All other chords must be considered as modifications of one or the other of these harmonies.

Further, the chords of primary tonal significance within a key are those of the Tonic, Dominant, and Subdominant. These three chords, the first of which is taken as harmonic centre, the second as the harmony of the upper Fifth ("overtone" series), and the third as the harmony of the lower Fifth ("undertone" series) define the key-system. As for the secondary triads on the second, third, sixth, and seventh degrees of the scale, these are described as *parallelklangs*, *quasi-consonances* (*Scheinkonsonanzen*) and in other ways, or as derived from discords.

The principles on which Dr. Riemann has built his system are thus briefly stated in the "Introduction" to his work :—

I. "There are only two kinds of *klangs* : overklangs and underklangs. All dissonant chords are to be conceived, explained, and indicated as modifications of overklangs and underklangs.

II. "There are only three kinds of tonal functions, namely, tonic, dominant, and subdominant. In the change of these functions lies the essence of modulation."

In accepting Rameau's explanation of the generation of the major harmony, and the nature of the major key-system, Dr. Riemann adds nothing to the considerations already advanced by the French theorist. All the sounds of the major harmony combine so as to form a single *klang*. The seventh upper partial tone, as well as others higher in the harmonic series, cannot form part of such a *klang*, for such tones are "out of tune."¹ In the key-system, the upper Dominant is derived from the overtone series and the lower Dominant from the undertone series. Rameau however, it should be remembered, ultimately abandoned his theory of the existence of a real series of "undertones."²

¹ *Harmony Simplified*, "Introduction," p. 6.

² See p. 232.

“ OVERKLINGS ” AND “ UNDERKLINGS ” : THE KEY-SYSTEM.

In regarding, however, the Fifth of the minor harmony as the fundamental note, and especially in the application of his conception of the “ underklang ” to the theory of harmony, Dr. Riemann parts company with Rameau. One or two results of the application of the “ underklang ” theory to the minor key-system may be noted. In the minor key-system which Dr. Riemann recognizes as the most representative,

$$\begin{array}{ccc} \overbrace{d-f-a} & \overbrace{a-c-e} & \overbrace{e-g\sharp-b} \\ d-f-a & a-c-e & e-g\sharp-b \end{array}$$

a must be regarded as the fundamental note of the minor harmony $\overbrace{d-f-a}$; while *e*, as fundamental note of the minor harmony $\overbrace{a-c-e}$, appears as the Tonic. This note *e*, however, is also the fundamental note of the major harmony $\overbrace{e-g\sharp-b}$. Is, then, the note *e* both Tonic and Dominant at one and the same time? It results further that in the Perfect Cadence in the minor mode there is no real harmonic progression from a Dominant to the Tonic which determines it. Thus, in the succession $\overbrace{e-g\sharp-b} - \overbrace{a-c-e}$, the note *e* must, Dr. Riemann considers, be regarded as the fundamental note of both chords. There is therefore no real Cadence, but only a species of harmonic oscillation; *e* appears as a sort of pivot or fixed point on which the harmony may swing from one side to the other. But this does not at all accord with the nature of the Cadence, in which, as every musician feels, there is a real movement and progression of the harmonies.

Again, if the central harmony of this mode is $\overbrace{a-c-e}$, then *e*, as the fundamental note of this Tonic harmony, is the Tonic of the mode. But the major harmony $\overbrace{e-g\sharp-b}$ has also *e* as its fundamental. The harmony $\overbrace{e-g\sharp-b}$ must therefore properly be regarded as a Tonic harmony. In this mode, therefore, there is no Dominant harmony. Instead, we find a Subdominant harmony $\overbrace{(d-f-a)}$, and two Tonic harmonies, one of which $\overbrace{(a-c-e)}$ is determined downwards, and the other $\overbrace{(e-g\sharp-b)}$ upwards.

But if it results from Dr. Riemann's theory that in the minor Perfect Cadence the "fundamental bass" remains stationary, in the common change from a minor mode to its tonic major, on the other hand, it is necessary to suppose that there occurs a real movement and succession of the harmonies, for here the "fundamental bass" descends a Fifth. Thus in the succession $\widehat{c-e\flat-g}--\widehat{c-e-g}$, the fundamental note of the first chord, according to Dr. Riemann, is g , and that of the second c .

With regard to the ascending form of the Melodic Minor scale, which has $f\sharp$ as well as $g\sharp$, matters are no better. For here :—

$$\begin{array}{c} \widehat{a-c-e} \\ \widehat{d-f\sharp-a} \quad \widehat{e-g\sharp-b} \end{array}$$

d is the fundamental note of the Subdominant "overklang," while e is the fundamental of the Tonic "underklang." That is, the Subdominant, in this case, is not a Fifth but a Ninth below the Tonic.

To Dr. Riemann and others of the post-Helmholtz school of writers already referred to, who claim that the major mode must be regarded as composed of a system of "overklangs," and the minor mode, the antithesis of the major, of a system of "underklangs," it must be somewhat disconcerting to discover the presence of "overklangs" in the minor mode. Dr. Riemann, however, is of opinion that this defect may be remedied by means of the introduction of an "underklang" in the *major* mode. An analogy is then perceived to exist between this minor-major scale, and the harmonic form of the minor scale : thus :—

$$\text{Harmonic minor :—} \begin{array}{c} \widehat{a-c-e} \\ \widehat{d-f-a} \quad \widehat{e-g\sharp-b} \end{array}$$

$$\text{Minor-major :—} \begin{array}{c} \widehat{c-e-g} \\ \widehat{f-a\flat-c} \quad \widehat{g-b-d} \end{array}$$

In this minor-major scale the fundamental note of the Tonic harmony is at the same time the fundamental note of the Subdominant harmony.

Dr. Riemann, however, agrees that this is not the "pure major" scale, which is of the form $c-d-e-f-g-a-b-c$. What then is the "pure minor" scale? This is not, as might be expected, of the form $a-b-c-d-e-f-g-a$, but of the form $e-f-g-a-b-c-d-e$. This *descending* scale, Dr. Riemann points out, is of exactly the same form, and consists of the same order of tones and semitones as the major, but in inverted order. That is, it is exactly the reverse of the major scale:—

$$\begin{array}{c} c-d-e-f-g-a-b-c \\ e-d-c-b-a-g-f-e. \end{array}$$

It is unfortunate that the minor scale which Dr. Riemann presents to us as the direct antithesis of the major is not our minor scale at all. Dr. Riemann considers it to represent the Dorian Mode of the Greeks. This however it does not do. The Greek Dorian Mode had Pythagorean tuning, with dissonant Thirds and Sixths. But even if we suppose such a scale to have originated from a system of consonant "klangs," it is impossible to regard it as being consistently generated downwards, or as composed exclusively of "underklangs":—

$$\begin{array}{ccc} & \text{Min.} & \\ & d-f-a & \\ g-b-d & & a-c-e \\ \text{Maj.} & & \text{Min.} \end{array}$$

If Dr. Riemann is bent on discovering a minor key system which can be consistently regarded as generated *downwards*, and as composed exclusively of a system of "underklangs," it is quite possible to find one:—

$$\begin{array}{ccc} & \text{5th} & \\ & a-c-e & \\ d-f-a & & e-g-b \text{ fundamental note.} \\ & \text{5th} & \end{array}$$

Here b is the starting point, and fundamental note of the mode; e is its Fifth below; while a is Fifth below e . The scale which results from this system of "underklangs" has therefore the form $b-a-g-f-e-d-c-b$.

Similarly with regard to the major mode:—

$$\begin{array}{ccc} & \text{5th} & \\ & c-e-g & \\ \text{Fundamental note} & f-a-c & g-b-d \\ & \text{5th} & \end{array}$$

Of the Subdominant harmony in this mode, that is, *f-a-c*. Dr. Riemann himself states that *f* is the fundamental note : *c*, therefore, is its Fifth, and *g* is Fifth of *c*. The note *f* represents the starting point of this mode, and now the mode may be consistently regarded as generated *upwards*. The scale, then, with *f* as starting point, has the form *f-g-a-b-c-d-e-f*.

Dr. Riemann however knows well that this will not do ; but finds it necessary, for the major mode, to have recourse to the "undertone" series (Subdominant), and for the minor mode, to the "overtone" series (Dominant).

It is, again, a decidedly awkward circumstance that the minor scale should have three different forms, while the major has but one. Dr. Riemann does not help us to understand why this should be. As for the relationship between the major and minor modes, he does not add anything to the explanations already advanced by Rameau. He considers that this relationship is sufficiently explained by the great number of sounds which a major and its relative minor mode possess in common. This, so far as it goes, is quite a good reason ; but plainly it cannot be the only nor indeed the chief explanation. For if the degree of relationship between two keys is determined by the sounds they have in common, then how is it that, for example, E major with four sharps is more closely related to C major than is D major with only two sharps ; and similarly with other keys ? Another difficulty is that the relationship between the Tonic of a major and of its relative minor key is that of a minor Third. Dr. Riemann however strongly holds, with Hauptmann, that the minor Third is not a "directly intelligible" interval. And yet the relationship between the two keys is of the closest possible kind.

Dr. Riemann appears to be of opinion that by means of his system of "overklangs" and "underklangs," for the notation of which he has invented special signs, he has greatly simplified the science of harmony. On the contrary, one may assert that what with "underklangs," "contra-klangs," "contra-fifth klangs," "plain-fifth klangs," etc., he has made of harmony, especially considered in its didactic aspect, a subject of quite needless complexity. It is needless, because in a succession of chords the student does not understand, for very good reasons, the Fifth of the minor harmony as the fundamental note. It is needless also, because Dr. Riemann,

strange as it may appear, in the very work in which he has developed his system of "under-klangs," "contra-fifth klangs," etc., himself tells us that in the minor harmony the *lowest* note ought to be regarded as the fundamental note. He makes the following statements, surely the most extraordinary, in the circumstances, which have ever proceeded from a musical theorist. He says:—"The under-klang, which on account of the peculiar dependence of its notes on a higher principal note appears to tend downwards, first receives a *firm basis* through the *choice* of the under-fifth for its bass note."¹ *Consequently*, he points out, this "under-fifth is the best note to double, and the fundamental note, the *Prime*, may be omitted"! It is evident that Dr. Riemann has an uneasy feeling that all is not right, for at this point he adds a long note of explanation:—"In order more fully to explain the somewhat strange-looking fact that in the 'under-klang' the *Fifth* [that is, the lowest note of the chord] *forms the fundamental note* [!], we submit the following short considerations."² The passage is too long to quote, but it is worth reading. Its perusal, and the consideration of all the facts, make the reader disposed to wonder how it is that Dr. Riemann does not appear to have a sense of humour. It is Dr. Riemann who, in the majority of his works, has insisted that the minor harmony must not be regarded as generated upwards; also, that harmony must be understood as a logical and rational science.

"CHARACTERISTIC DISCORDS."

The dissonant chords recognized by Dr. Riemann ("characteristic dissonances") are, in the major mode, the chord of the Dominant Seventh, and the chord of the Added Sixth—Rameau's Subdominant discord. Here the method of procedure is similar to that of Rameau; and so also the explanation as to the necessity for adding a dissonant note to the Dominant and Subdominant chords, namely, that by such means the real character of these chords is rendered perfectly clear, and there is no danger of their being mistaken for Tonic chords. It is by no means certain, however, that

¹ *Harmony Simplified*, Ch. I.

² *Ibid.*

the tendency of the Subdominant harmony towards that of the Tonic is made more decided by the addition of a dissonant note to its harmony.

In the minor mode, as in the major, we find a Dominant and a Subdominant discord. In a minor, the Dominant discord is $e-g\sharp-b-d$, and the Subdominant discord $b'd-f-a$. Here the analogy which Dr. Riemann wishes to maintain between the major and the minor modes again breaks down. He fails to show why, in the case of the Subdominant discord in the major, as $f-a-c-d$, the interval added above the major harmony $f-a-c$ should be a *Sixth*, while in the case of the same discord in the minor, as $b'd-f-a$, the interval added below the minor harmony $d-f-a$ is a *Seventh*; especially as the "function" and meaning of both chords is the same. There is really no good reason why the Subdominant discord in the minor should not appear, like that in the major, as a chord of the Added Sixth: $d-f-a/b$.

It would be possible however to preserve a strict analogy in respect of the construction of these two discords, if the *Sixth* were added *below* the minor harmony $d-f-a$, in the same way as the *Sixth* had been added *above* the major harmony. Between the chord of the Added Sixth in the major $f-a-c-d$, and the chord of the Added Sixth in the minor $c-d-f-a$, there would then exist a real analogy, as respects the construction of these chords. Dr. Riemann however does not consider this alternative.

Instead, he distinguishes a certain chord of the Added Sixth in the minor mode which, he seems to imagine, is the counterpart of the chord of the Added Sixth in the major. This chord is $d'e-g-b$ (*a* minor). It is however not a Subdominant but a Dominant discord. It is difficult to consider that any real analogy exists between a *Dominant* chord of the Added Sixth in the minor mode, and a *Subdominant* chord of the Added Sixth in the major mode. This chord $d'e-g-b$ appears to have been introduced by Dr. Riemann merely in order to impart to his system of "characteristic dissonances" an appearance of symmetry.

It may also be noticed that the Dominant discord in the major, as $g-b-d/f$, and the Subdominant discord in the minor, as $b/d-f-a$, are composed of exactly the same intervals. The former consists of a major Third, perfect Fifth, and minor Seventh; the latter consists of the same intervals in

descending order. A strict analogy exists, therefore, as respects their construction, between the *Subdominant* discord in the minor mode, and the *Dominant* discord in the major mode. Dr. Riemann, however, brings forward a new species of Subdominant discord in the major, namely, $d/f-a\flat-c$, which he regards as analogous to the Subdominant discord in the minor mode $b/d-f-a$. But this new discord has not an ascending but a *descending* construction. It should properly have been compared with the minor *Dominant* discord, which consists of exactly the same intervals, but taken in ascending order. The major key-system is now in possession of *two* Subdominant discords, while the minor key-system has but one.

But with respect to the new Subdominant discord $d/f-a\flat-c$, Dr. Riemann had already plainly stated that " $a\flat$ is foreign to the key of C major, as $g\sharp$ is foreign to that of *a* minor [!] . . . The contra-clang of the Tonic [$f-a\flat-c$] is really a plain-fifth clang of the Tonic-Variant, *i.e.*, of a Tonic of the other clang-mode; the F minor chord in C major is really the plain-fifth clang [Subdominant] of the C minor chord."¹

" PARALLEL-KLANGS."

Another feature which distinguishes Dr. Riemann's work from previous works on harmony, is his theory of what he describes as "Parallel-klangs." Rameau, although he had demonstrated that the key-system received its complete definition by means of the three principal harmonies of Tonic, Dominant, and Subdominant, had never been able to furnish any adequate explanation as to the nature and origin of the secondary triads of the key, with one exception, namely, the diminished triad on the leading-note, which he had explained as derived from the chord of the Dominant Seventh, through omission of the fundamental note. Dr. Riemann accepts Rameau's explanation of this chord, and in doing so proves his superiority to other theorists who have explained it as an independent chord, and given it a place among even the primary triads of the key.

¹ *Harmony Simplified*, Ch. 1.

Dr. Riemann's "parallel-klangs" are the secondary triads on the second, third, and sixth degrees of the scale. In his treatment of these chords he makes a notable attempt to develop and complete Rameau's theory as to the origin of the various triads of the key-system. He recognizes the necessity which exists to explain these secondary triads as arising in a different way from the primary. But unfortunately it is by no means an easy matter to ascertain what exactly Dr. Riemann wishes us to believe concerning these secondary triads. In his *Musiklexikon* he gives the following terse definition of "parallel-klangs":—"Parallel-klangs are klangs which stand to each other in the relationship of tonics of parallel keys; for example, C major and A minor; that is, klangs which possess a third interval in common: $\overbrace{a-c-e-g}^{5th}$." If,

then, in the major chord $c-e-g$, which represents the Tonic chord of C major, we substitute the note a for g , we obtain the "parallel-klang" $c-e-a$. This "parallel-klang," therefore, must be understood as follows:—The notes $c-e$ represent the fundamental note and Third of the Tonic chord of C major, while a is the Tonic of a minor. The chord therefore is derived from two keys, C major and A minor.

The triad on the second degree of the C major scale would therefore appear similarly to be derived from the keys of F major and D minor; and that on the third degree from the parallel keys of G major and E minor. It is clear that Dr. Riemann cannot mean to present this as an adequate explanation of the origin of the secondary triads in question.

This explanation of the secondary triads on the second, third and sixth degrees of the scale would appear to apply to the major key-system only; there are obviously serious difficulties in the way of its application to the minor key-system. For example, the triad on the second degree of the minor scale is a diminished triad, while that on the third degree is augmented.

Dr. Riemann, however, gives another and a quite different explanation of the "parallel-klang." He explains the Subdominant "parallel" as being derived from the "characteristic dissonance" on the Subdominant, as $f-a-c'd$, by means of the omission of the Fifth, C. The other "parallel-klangs," that on the sixth degree of the major scale, $a-c-e$ or $c-e-a$, and that on the third degree, $c-g-b$ or $g-b-e$, cannot, however, be

similarly explained. "These cases have to be explained in a different way, since for the tonic there can be no characteristic dissonance, and the dominant klang, with its own characteristic dissonance, cannot produce any quasi-consonance."¹ But Dr. Riemann fails to discover any adequate explanation of the "cases which have to be explained in a different way." It is impossible to understand why he should describe the triad *d-f-a* as a "parallel-klang," seeing that it is derived from, and represents, in incomplete form, the Subdominant discord *f-a-c/d*. There is another reason why this triad cannot be considered as a "klang": it consists not only of a dissonant Fifth, *d-a* (27 : 40), but of a dissonant Third *d-f* (27 : 32).

But we find still another explanation of these "klangs" as "leading-tone-change-klangs" (*Leittonwechselklänge*). It is evident that Dr. Riemann has no settled idea as to what his "parallel-klangs" really are, and what they really stand for. Still, if we select one out of the various and contradictory explanations which Dr. Riemann has given of these "klangs," it is possible to perceive what it is he is principally aiming at. His theory of "parallel-klangs" is the necessary complement of his theory of "tonal functions of chords," in which he lays down the principle that every chord within the key-system must have either a Tonic, a Dominant, or a Subdominant significance. When, then, he defines "parallel-klangs" as "klangs which stand to each other in the relationship of tonics

of parallel keys" as $\overbrace{a-c-e-g}$, he is evidently of opinion that he has demonstrated the possibility of considering both chords as having a parallel or similar "tonal function." That is, he wishes us to consider the minor "klang" on the Submediant in C major—or is it the Tonic in A minor?—as having the same harmonic significance as the major "klang" *c-e-g*, that is, a Tonic significance. Similarly, we must consider the "klang" on the Supertonic to have a Subdominant, and the "klang" on the Mediant a Dominant significance, or function. It is not difficult to discover whence Dr. Riemann has derived this theory. It was Helmholtz who stated, in his explanation of the minor harmony, that the minor triad, for example, *a-c-e*, may appear in the form *c-e-a*, in which form it is to be considered as a C klang, in which the foreign note *a* takes

¹ *Harmony Simplified*, Ch. 1.

the place of *g*. Unfortunately Dr. Riemann, in several of his works, has made it one of his principal tasks as a theorist to demonstrate the utter impossibility, even absurdity, of any such explanation of the minor harmony, which must be regarded as the antithesis of the major, and as being generated downwards, not upwards.

THE THREE TONAL FUNCTIONS OF CHORDS.

In Rameau's explanation of the diatonic key-system as determined by the three primary harmonies of the key, we find the origin of Dr. Riemann's theory of the "tonal functions of chords." Every chord within the key-system must, according to Dr. Riemann, represent one or other of the three chief harmonies of the key. This is an important theoretical conception, and one which Dr. Riemann, in *Harmony Simplified*, has made a notable attempt to develop. If such a theory is really feasible, the result undoubtedly is greatly to simplify the science of harmony. But the difficulties in the way of its application as a theoretical principle are not a few.

Dr. Riemann, then, sets himself to demonstrate that every chord within the key-system has, and must have, either a Tonic, Dominant or Subdominant function or significance. For example, the secondary triad on the sixth degree of the scale of C major, *a-c-e*, or rather *c-e-a*, is a Tonic "parallel," and has a Tonic significance, because the chord represents the C major "klang," into which the foreign note *a* is introduced. This, as we have seen, is the explanation which Helmholtz has given of this minor chord. This being the case, Dr. Riemann is of opinion that the Deceptive Cadence, in which this chord plays a part, is the result of a Dominant-Tonic succession of harmonies.

He gives the following examples of the Deceptive Cadence:—

(a) (b) (c)

D Tp D °Tp °S °Tp

In examples (a) and (b) Dr. Riemann is of opinion that the ear understands a Dominant-Tonic harmonic succession in the key of C major, and in example (c) a Subdominant-Tonic succession in the same key! If not, his use of the signs D—T and S—T has no meaning. The manner in which the ear understands the chord *c-e-a* to be derived from *c-e-g* he has already explained. It is more difficult to understand how *e♭-g-b♭* can represent and be derived from the chord *c-e-g*. The process of evolution is as follows:—*c-e-g* = the "Tonic Variant," *c-e♭-g* = the "Tonic-parallel" of this "Variant" *b♭-e♭-g*. Therefore *c-e-g* = *b♭-e♭-g*!

In the same way, the following are to be understood as Dominant-Tonic successions in A minor! The chord *f♯-a-c♯* is derived from *a-c-e* as follows:—



a-c-e = the "Tonic Variant," *a-c♯-e* = the Tonic-parallel of this "Variant" *a-c♯-f♯*. These are extraordinary results.

In the following harmonic succession (a):—



Dr. Riemann considers both chords to be in the C major key. He is evidently much puzzled as to how the first chord *e-g♯-b* should be denoted. First he marks it as (D) because "it has a kind of Dominant significance," but assigns to it also the mark (Tp) (*c-e-g* = *b-c-g* = *b-e-g♯*).

But, he remarks, "the $g\sharp-gb$ as a cadential step is not quite logical." In order, then, to obtain for this chord "real cadential significance" it should be understood as at (b). Dr. Riemann also suggests the possibility of explaining this chord succession as arising through an "elision." That is, a "mediating" chord $a-c-e$ is understood (c). In one and the same harmonic succession, therefore, the chord $e-g\sharp-b$ may be understood in three different ways: first, as a "kind of Dominant," next, as a "Tonic-parallel," lastly, as a "Dominant-parallel."

Similarly with the succession $a\flat-c-e\flat-c-e-g$, which Dr. Riemann explains in the following different ways:—

(a) (b) (c)

Sp T Svii T

He apparently considers that in such a succession $a\flat-c-d\sharp$ may quite well be substituted for $a\flat-c-e\flat$, just as $e-a\flat-b$ may be substituted for $e-g\sharp-b$.

Dr. Riemann gives several other examples of chords (of which only a few need be quoted) to which he is unable to ascribe either a Tonic, Dominant, or Subdominant significance:—

(a) T * (b) T * (c) D *

6 > 4 > 2 > 7 < 4 < 2 < 6 > 4 > 2 >

Nevertheless he says of them, "as they are *quasi*-consonances, they share with all such the peculiarity that they may be

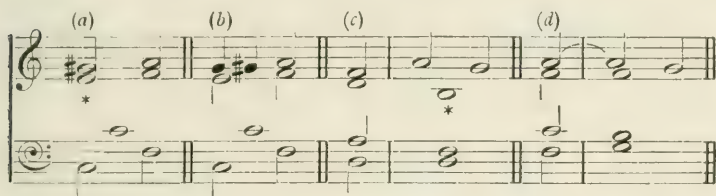
treated as real harmonies." That is, although they "may be treated as consonances," they must nevertheless not be understood as such. But if they are *quasi*-consonances, they represent at least as real harmonic formations as the "parallelklänge" to each of which Dr. Riemann has found it possible to assign a "tonal function." The real difficulty is, of course, that Dr. Riemann is unable to account for these chords, or to explain their "tonal functions," except that they arise from "leading-tone steps."

A word must also be said with respect to Dr. Riemann's theory, or rather theories, as to the origin of chords. Of consonant chords there are but two, the major and the minor harmonies. Of dissonant chords, Dr. Riemann has stated that "all dissonant chords are to be explained as modifications of overklänge and underklänge." He therefore follows Kirnberger in a notable attempt to reduce all harmonic formations to a few simple primary chords, and in making a firm stand against all theories of "fundamental discords," or of chord formation by means of added Thirds, he has done a real service to the science of harmony. But in getting rid of the "added Third" theory he by no means gets rid of the difficulties which beset the problem of chord generation. He has made us acquainted with a number of "characteristic discords" which cannot properly be said to arise from the modification of a major or minor harmony. For example, the chord of the Added Sixth, $f-a-c/d$, cannot be understood as a modification or alteration of the major harmony, $f-a-c$. Nor can the note d in this chord be regarded as having no harmonic significance, as a non-harmonic note. Dr. Riemann has stated that the addition of this dissonant Sixth "renders the meaning" of the Subdominant harmony "still clearer."

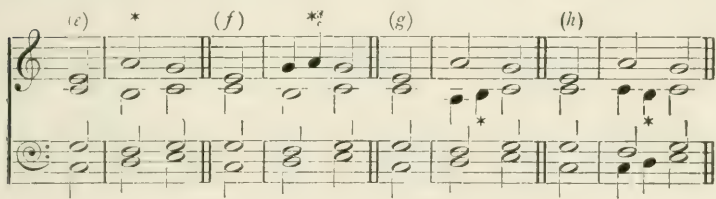
MELODICALLY ALTERED CHORDS.

As for all other dissonant formations, he is of opinion that these have their origin in "melodic figuration"; that is, they represent in reality modifications of "overklänge" and "underklänge" brought about by means of the introduction of passing- and auxiliary-notes, etc. Thus the chord * in example (a) has its simple origin in a chromatic passing-note

(b) ; while the chord *b-d-f-a* in example (c) has its origin in a suspension (d)¹ :—



But let us take from among many such chords the familiar chord *b-d-f-a*, as in example (e) :—



Here the note *a* cannot very well be explained as arising from a suspension, or a passing-note. It is true that by means of distorting the melody a plausible explanation of the note may be found (*f*). In any case, Dr. Riemann assumes that the note *a* is the note of melodic figuration. He may be right ; but, theoretically considered, this is a mere assumption. Why should not the notes *d-f-a*, rather than *b-d-f*, represent the true harmony-notes, and *b* the note of melodic figuration, which arises as a passing-note, as at (*g*). This might even be maintained to be the more reasonable view, seeing that the “parallel-klang” *d-f-a* is *quasi-consonant*, while *b-d-f* is decidedly a discord. Still other views are possible. For example, *f* and *a* might be regarded as the actual harmony notes, while *d* arises as a passing-note, and *b* as an auxiliary-note (*h*).

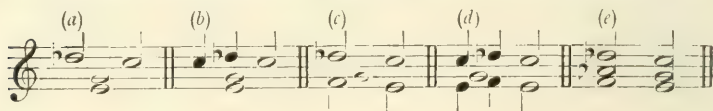
But, as we shall see, Dr. Riemann is of opinion that “harmony has its roots in melody.” Hauptmann, not without reason, has stated that the essence of melodic succession is

¹ *Harmony Simplified*, Ch. 3.

progression by step. In the chord we are considering, then, it would be reasonable to assume that the notes of melodic figuration are those which proceed by step, namely *b-d-f*, while the note *a*, which proceeds by leap, is the harmony note, representing perhaps the fundamental note of the "parallelklang" *a-c-e*.

But it is really astonishing, in the case of theorists who claim that harmony arises from melody, to observe with how little compunction such theorists distort and torture the melody for which they profess so much regard, and even lop off a member here and there from a chord, in order to make it fit the Procrustean bed of some preconceived harmonic formation.

Another species of discord explained by Dr. Riemann is that which owes its origin to a "leading-tone step progression":—



Thus in the chord at (a) (key of C major) the *d♭* is a leading-note which tends towards and takes the place of the real harmony note *c*. The real origin of the chord is seen at (b). This is at least an intelligible and even reasonable explanation. Dr. Riemann, however, does not consider it necessary to inform us how this note *d♭*, in Hauptmann's language, "acquires definiteness." It does not even appear that definiteness of intonation is necessary. Not being harmonically determined nor possessing any independent harmonic significance, it is apparently only necessary to intone this sound as leading-note to *c*. Consequently neither the singer nor violinist will be careful to be accurate in his intonation of *d♭*; indeed it is very improbable that he could be accurate, if the *tuning* of *d♭* is to be determined by means of the sounds of the chord which appear below it.

We now come to a discord consisting of *two* leading-notes, *d♭* and *f*, and *one* harmonic note, *g*, as in example (c). This chord finds its explanation at (d). Still another discord is that composed *entirely* of leading-notes, and in which there is, presumably, no harmonic note (e). There can be no question as to the dissonant character of this chord: for the notes

$f-a\flat-d\flat$, taken in free melodic intonation, represent as discordant a combination as could well be desired. Dr. Riemann, however, is of opinion that this chord may be considered as consonant. It is, in fact, not only a consonant chord, but one of the most important consonant chords used in harmony.

In a similar way, Dr. Riemann might consider that in the following passage, which is taken from Wagner's *Tristan*:—



the chord at * represents a discord composed entirely, with the exception of the lowest note $g\flat$, of chromatic leading-notes. These notes, therefore, have only a melodic significance. They introduce no real change of harmony. Throughout the whole passage, the only actual harmony, whether from a purely theoretical point of view, or from the effect produced upon the ear, is that of the Tonic chord $g\flat-b\flat-d\flat$. All this of course is the grossest travesty of the actual facts. The chord in question does, very decidedly, introduce a fresh harmony, and brings about a very real harmonic change.

In *Harmony Simplified*, Dr. Riemann has endeavoured to develop and establish two main theoretical principles, neither of which is new, but which are derived from other theorists. The first is that not only the minor harmony but the minor key-system must be regarded as the direct antithesis of the major harmony and major key-system. It can scarcely be maintained that Dr. Riemann has succeeded in establishing this part of his theory. On the contrary, anything more topsy-turvy it would be difficult to imagine, except it be his treatment of the "parallel-klangs." First, the minor harmony arises from the "undertone" series, and is the antithesis of the major, which arises from the "overtone" series. Secondly the objective existence of a series of "undertones" cannot be proved, and therefore the minor harmony can only be explained as a psychological fact, as a fact of experience.

That the highest and not the lowest note must be regarded as the fundamental note of the minor harmony results also as a fact of experience. But thirdly, in practice the lowest note of this harmony should be regarded as the fundamental note, while the real fundamental may be omitted without altering the fundamental position of the chord.

Dr. Riemann's second main theoretical principle is that every chord within the key-system must have either a Tonic, a Dominant, or a Subdominant "function" or significance. He completely fails to prove this, for the very good reason that there are chords within the key-system which do *not* possess a Tonic, Dominant, or Subdominant significance. Of the existence of such chords he is himself aware, but is unable to discover any adequate explanation of them. In order to ascertain the exact value of Riemann's theory of "tonal functions" and "parallel-klangs," all that is needed, it might be imagined, is to cast a glance at his designation of the following chords (in C major):—

D F D cTp Dp⁴ T Svii < T

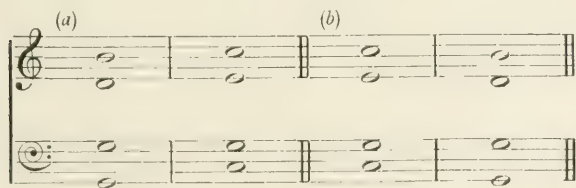
It is an offence not only against the ear but against the intelligence of the average musician to ask him to believe that chords such as *ah-c-ch* and *ch-g-bh* stand for, or represent, the Tonic chord *c-e-g*.

CHORD-SUCCESSION: BASIS OF THE THEORY OF HARMONY.

Dr. Riemann's theory of tonal functions has evidently been inspired by Rameau's fundamental bass in Fifths. But although his appreciation of the theoretical significance and value of Rameau's bass does him credit, he is by no means prepared to accept its limitations. He is quite prepared to accept Rameau's fundamental bass, but he is unwilling to be

hampered by the difficulties which arise in connection with it. He sees no difficulty in the way of the immediate succession of both Dominants, and is even of opinion that Rameau evinced a quite unnecessary sensitiveness on this point. He is by no means certain that it is the fundamental bass which determines the sounds of the scale. He is even less prepared to state that it is the fundamental bass which determines and explains chord-succession, although it might have been imagined that this was one of the principal objects of his theory of "tonal functions." In the "Introduction" to his work we read:—"The theory of harmony is that of the logically rational and technically correct connection of chords (the simultaneous sounding of several notes of different pitch). The natural laws for such connection can be indicated with certainty only if the notes of single chords be regarded, not as isolated phenomena, but rather *as resulting from the motions of the parts.*"

If this statement has any meaning for the theory of harmony then we must consider chord-succession to be determined by the "melodic tendencies" of the parts. In the perfect cadence, then, (a), we must believe that the progression of the first chord to the second is brought about by the tendency of *b* to proceed to *c*, of *d* to *e*, and so on:—



In the half-cadence (b) the succession is determined by the tendency of *c* to proceed to *b*, of *e* to *d*, and so on, that is the sounds have now exactly the opposite tendencies! Is it only in the case of "over-klänge," "under-klänge," "contra-klänge," etc., that we must consider the constitutive harmonic elements of a chord to be "isolated phenomena"? Is it by means of the "motions of the parts" that Dr. Riemann has been enabled to determine the connection between the

harmonies in the examples of "parallel-klangs" just given, and to assign to each chord its correct tonal function?

Indeed, one of the puzzles presented by Dr. Riemann's works on harmony is that of ascertaining what exactly is the position of their author with respect to the basis of the theory of harmony. At one time he discovers for it a physical, at another, a psychological basis. As a rule he accepts both. He suggests that harmony has its origin in melody. It is not for nothing that Dr. Riemann makes this statement. He has in view the large number of chords for which he can find no explanation except that they arise through melodic figuration. But immediately after this pronouncement we find him engaged in investigating the "undertone" and "overtone" series, and numerous species of klangs.

It is probably in order to justify this procedure that he remarks towards the end of his work:—"Harmony is certainly the fountain-head from which all music flows, but the diatonic scale is the primeval bed, the banks of which the stream may at times overflow, but into which it is always forced again"! Ought we to conclude from these remarks that, in the first place, harmony is derived from the scale, and that, in the second place, the scale is derived from harmony?

Dr. Riemann has based his work, as of course he has a perfect right to do, on principles derived from Rameau, Kirnberger, Fétis, Hauptmann, and Helmholtz. These principles, however, frequently mutually opposed to one another, we find strangely jumbled together. Dr. Riemann has adopted certain theories without having sufficiently considered whether, in the first place, they are tenable, or where, in the second place, they are likely to lead him; witness his operations with regard to the "undertone" series, and the fundamental note of the minor harmony. In *Harmony Simplified* we have the latest noteworthy attempt to evolve a logical harmonic system, by one of the most erudite musicians and theorists of his day. The whole work is an eloquent testimony, not only to the enormous difficulties of the subject, but as to the actual state of harmonic science at the beginning of the twentieth century. In no previous work of the kind—not even in Helmholtz—does one observe such extraordinary uncertainty, hesitation, and evasion as to what constitutes the fundamental principles, and indeed even the proper basis of harmony.

CHAPTER XIII.

ENGLISH THEORISTS: DAY, MACFARREN, OUSELEY,
STAINER, PROUT.

DAY'S *TREATISE ON HARMONY*.

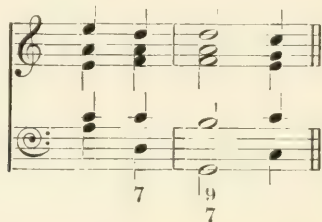
OF works on harmony by English writers, the first and in many respects the most important to be mentioned, is the *Treatise on Harmony* by Alfred Day, M.D. Dr. Day's treatise represents a characteristically straightforward attempt to reduce harmony to its fundamental principles, and to evolve from such principles a rational theory of harmony. In the "Preface" to his work he remarks:—"The following work is the result of immense labour during the leisure time of many years." The work itself was published in 1845, only a few years before his death (1849).

Dr. Day divides his work into two main sections. In the first he treats of Diatonic or Strict, and in the second of Chromatic or Free, harmony. In so doing he makes some remarkable distinctions. In the first section he explains the major scale as determined by the three principal harmonies of the key:—"The foundation of the major scale is the common chord of the tonic, which supplies the first, third, and fifth of the key; of the dominant, which supplies the major seventh and second, and of the subdominant, which supplies the fourth and sixth."¹ Likewise, with regard to the sounds of the minor mode, in which we find a minor harmony on the Tonic, a major harmony on the Dominant, and a minor harmony on the Subdominant. In the second part of his work however

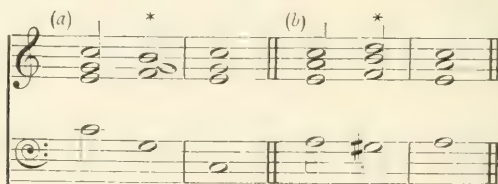
¹ *Treatise on Harmony*, Pt. I., Ch. 2.

he gives, as we shall see, quite a different explanation of both the major and minor scales.

Again, while "Diatonic" harmony allows of such harsh combinations as the following* :—



it does not permit of such comparatively innocuous harmonic successions as those of Dominant and Diminished Sevenths preceded and followed by the Tonic chord (*a, b*) :—



the reason being that in the first case the discords are, or are said to be, prepared, while in the second they are taken without preparation. The chord of the Dominant Seventh therefore, when prepared, belongs to Diatonic harmony; when unprepared, to Chromatic harmony.

Not only so, for this chord has two different origins: if prepared, the dissonant note is derived from the Subdominant; if unprepared, the whole chord, dissonant note included, is generated from the Dominant. These are a few of the curious distinctions drawn by Dr. Day between diatonic and chromatic harmony.

CHROMATIC HARMONY : THE KEY-SYSTEM :
GENERATION OF CHORDS.

In the second part of his work, entitled *Chromatic Harmony, or Harmony in the Free Style*, Dr. Day treats of what he calls "natural discords." He remarks:—"Diatonic discords require preparation because they are *unnatural*; chromatic do not, because they may be said to be *already prepared by nature*."¹ He therefore suggests that, for example, the chord of the Dominant Seventh, when prepared, is an "unnatural discord"; the dissonant Seventh is not derived from nature. On the other hand, when the chord is taken without preparation, it is a "natural discord" and derived directly from nature.

Dr. Day's methods of procedure in respect of chord generation are similar to those with which previous works on harmony have made us already familiar; namely, the selection of certain sounds as "roots," and the building up upon these roots of chords and discords by means of sounds selected from the harmonic series.

"The harmonics from any given note (without taking the order in which they arise, but their practical use) are," he remarks, "major third, perfect fifth, minor seventh, *minor* or *major* [!] ninth, eleventh, and *minor* or *major* thirteenth." He does not suggest that these represent all the sounds of the harmonic series; there are, of course, many more. Dr. Day is evidently in no doubt as to what sounds he requires. He does not tell us how he has gained this knowledge; certainly not by the study of the sounds of the harmonic series.

From the sounds thus derived he obtains a major common chord, a chord of the minor Seventh, and so on, up to the chord of the major Thirteenth. These chords may be considered to arise from the Tonic; from the Fifth of the Tonic (*Dominant*), and from the Fifth of this Fifth (*Supertonic*); the reason for this being that "the harmonics in nature rise in the same manner: first, the harmonics of any given note, then those of its fifth or dominant, then those of the fifth of that dominant." But here Dr. Day quite overlooks the existence of the *Third* (*Seventeenth*) of the Tonic, which arises before the

¹ *Treatise on Harmony*, Pt. II., Introduction.

Fifth (*Twelfth*) of the Dominant. If he is guided as he professes to be by nature, and is selecting his "roots" according to the manner in which they arise in nature, then he must include the major Third of the keynote as a "root" before he proceeds to the Fifth of the Dominant, which only arises after this Third.

He informs us, however, that the Tonic, Dominant, and Supertonic are the three "roots" from which all chords in the key-system, major or minor, are derived. Conversely, all chords derived from these "roots" belong to one and the same key. It should be observed that the chord of the Eleventh can appear only on the Dominant:—



One may observe, also, that although the order of "roots" is determined, according to Dr. Day, by the manner in which they arise in nature, the order of sounds in the chords which spring from them is not thus determined. In the harmonic series we find first an Octave, then a Fifth, then a Fourth, and so on, the intervals gradually becoming smaller. But in Dr. Day's chords of the Tonic and Supertonic Thirteenth, the largest interval is at the top. Must we understand this as brought about by means of the omission of a Third? In any case, this is a defect which has been remedied by some of Dr. Day's disciples.

The reason why the order of "roots" cannot be continued beyond the Fifth of the Dominant is that, in the case of the next Fifth (Fifth of the Supertonic) "that note itself is not a note of the diatonic scale, being a little too sharp."¹ It is important to observe, then, that Dr. Day makes a sharp distinction between the sixth degree of the major scale and the Perfect Fifth above the Supertonic of this scale. Such a distinction is necessary, and is one made by every theorist of

¹ *Treatise on Harmony*, Pt. II., Introduction.

importance. The difference between the two sounds is that of a comma (80 : 81).

We are now in possession of all the sounds of the Diatonic Scale, major or minor. "The notes of the diatonic major scale are produced in the following manner : C (tonic) produces G, its fifth, and E, its major third ; G produces all the rest, as D its fifth, B its third, F its seventh, and A its major ninth. The minor scale in a similar manner : E \flat , the minor third, is an *arbitrary*, not a natural third, of C."¹ But the three "natural" and fundamental discords contain not only the sounds of the diatonic, but also of the Chromatic Scale, which, then, ought to be written thus (C major or minor) :—



The same method of notation should be employed for the descending chromatic scale.

But not only the major and minor (harmonic) scales, and the various kinds of "natural discords," but also the common chords which occur in the diatonic scale, are derived from the same source. Thus the Tonic "root" produces its own common chord ; "the *minor* [!] common chord on the major second of the scale is part of the chord of the minor seventh and major ninth on the dominant ; the common chord, major or minor, on the Subdominant, is part of the chord of the eleventh accompanied with the seventh, and either major or minor ninth ; the major common chord on the minor sixth of the scale is part of the chord of the minor thirteenth, accompanied by the eleventh and minor ninth ; the minor common chord on the major sixth of the scale is part of the chord of the major thirteenth, accompanied with the eleventh and major ninth."² With regard to the common chord on the major third of the scale, it "is not allowed, because it appears to belong to another key." As for chord-succession, a chord will proceed to another chord derived from the same "root," or from either of the other two "roots." Much in the same way, a discord will resolve either on its own "root" or on a chord derived from another root.

¹ *Treatise on Harmony*, Pt. II., Ch. 1.

² *Ibid.*

DAY'S "FUNDAMENTAL BASS": SYSTEM OF "ROOTS."

Such then in brief is the system of Dr. Day, which, in some respects, suggests to us the "simple and comprehensive" system of Catel, who also derived the various chords of which he had need from a single chord. But even more striking is the resemblance to be observed between the principles which influenced Dr. Day, and those which formed the basis of the theory of harmony of Rameau. Both agree that all the notes of the scale are developed from a single sound—the Tonic; that all chords must be developed from a single chord (for Dr. Day does not present us with three *different* chords, but with the *same* chord on different notes of the scale); and further, that the "roots" or fundamental sounds ("fundamental bass") of the key-system are three in number. But if the principles of both theorists present a striking resemblance, the difference between the results obtained is still more striking. Not only in musical intuition, but in theoretical acumen, Dr. Day proves himself to be much the inferior of the great Frenchman.

At the outset, Dr. Day lays down a definite principle that, he says, should guide us in determining which sounds ought to be accepted or rejected as roots. The Fifth of the Supertonic cannot be accepted as a "root," because it is sharper (80 : 81) than the major Sixth of the scale. He also states that the minor Third E \flat , for example, is not a root in the key of C, because its minor Ninth F \sharp contradicts the major Third E, the difference between the two intervals being the *enharmonic diesis* (125 : 128); also that wherever "this enharmonic diesis" takes place it always implies a change of key." Such being the case, one naturally expects that the principle which applies in the case of "roots" will apply also to the sounds of the "natural discords" which arise from these "roots." But if we take the discord of the Dominant Thirteenth *g-b-d-f-a-c-c*, which we have been led to suppose is generated from the "root" *g*, we shall find that the majority of its sounds do not belong to the scale of C major. The sound *f* is decidedly flatter (63 : 64) than the fourth degree of the major scale of C; *a* is sharper than the major Sixth (80 : 81); *c* is almost a quarter-tone (32 : 33) sharper than the Tonic, while *e* is much flatter

(39:40) than the third degree of the scale. According, therefore, to the principle laid down by Dr. Day himself, all the sounds *f-a-c* and *e* ought to be rejected. Nevertheless, Dr. Day informs us, from these sounds *f-a-c-e* we obtain the harmonic or consonant major harmony *f-a-c*, and the consonant minor harmony *a-c-e*. The proportions of the first are 7:9:11, and of the second 9:11:13. We therefore obtain harmonic and consonant (!) formations hitherto unknown to any musical system.

We presume, of course, that these sounds represent respectively the seventh, ninth, eleventh, and thirteenth upper partials of the "root" *g*. It is true that Dr. Day makes no absolutely definite statement to this effect. But although he has said that he has selected the harmonic sounds, not according "to the order in which they arise, but their practical use," it is difficult to conceive that he imagines himself at liberty to select, in an arbitrary way, whichever sounds he pleases from the harmonic series. If so, the subject is hardly worth discussing further. To pick out sounds here and there in such a way is in itself, no doubt, a quite harmless amusement, but it is decidedly erroneous to dignify such a procedure by describing it as harmonic science.

It is difficult to understand by what method Dr. Day obtains the sounds he requires. For example, he is able to present us not only with a major, but with a minor thirteenth. Nature provides him with neither, for the thirteenth harmonic sound is neither a major nor a minor thirteenth, but is, one may say, between the two. It would appear that Dr. Day considered this a sufficient reason for making use of both.

But with regard to the sounds *f-a-c-e*, Dr. Day tells us that these are sounds of the C major scale. If so, they cannot be derived from the harmonic series of which *g* is the prime. Further, it is impossible to understand how Dr. Day can describe such a combination as a "natural discord" generated from its "root" *g*. Dr. Day professes to be guided by nature; but it would seem that it is nature which requires the guidance of Dr. Day. He has led us to believe that he is going to produce certain sounds from the harmonic series; he does not produce them, but furnishes us instead with quite other sounds, which he has obtained from no one knows where.

But let it be supposed that the sounds comprised in the

Dominant discord $g-b-d-f-a-c-c$ are in reality those of the C major scale. In that case, it is clear that the sounds of the Supertonic discord $d-f\sharp-a-c-c-b$ cannot likewise belong to this scale. For example, a in this discord is sharper (80 : 81) than the a of the Dominant discord. This a is the (perfect) Fifth of the Supertonic, the same sound which Dr. Day rejected as a root because it was not the real sixth degree of the major scale. It ought to be rejected now. Similarly with regard to the Tonic discord $c-e-g-b\flat-d-a$.

Some apologists of the Day system, notwithstanding that Dr. Day himself draws a distinction between sounds which differ by a comma (80 : 81) have sought to defend Dr. Day's use of "natural discords" by references to our tempered scale, in which, with the exception of the Octave, everything is more or less out of tune. For certain theorists temperament reconciles all things. It is evident that such theorists have not contemplated what would be the result if the sounds of the "natural discords" on the Tonic, Dominant, and Supertonic, all of which, Dr. Day has assured us, belong to the major key-system, were actually placed in tune. What sort of scale would emerge from such a confusion of sounds? Notwithstanding the large number of new sounds and intervals, hitherto unknown in harmonic music, now in our possession, the effect of which would be to bring about a complete change in our harmonic system, and for which a new notation would require to be invented, we would still be without the sounds necessary to form a harmonic triad or consonant major harmony on the Subdominant, or a consonant minor harmony on any degree of the major scale, and similarly for several other of the most important chords of the key.

Although some of the combinations which Dr. Day succeeds in evolving from a single "root" are about as harsh in effect as any one could well desire, he explains, as is known, the comparatively mild discord of the Augmented Sixth as derived from a "double root." Thus, in the case of the Augmented Sixth $a\flat-f\sharp$, $a\flat$ is the minor Ninth of the "primary root" g , while $f\sharp$ is the major Third of the "secondary root" d . For this he has been much criticized, and somewhat unjustly, for to explain a discord as arising from a "double root," as Hauptmann did, is much more sensible than to explain it as arising from a single "root." Dr. Day, however, is far from identifying himself with Hauptmann's theory of

the dual origin of discords. The chord of the Augmented Sixth is the only chord he explains in this way, and it is an explanation which would appear to be forced upon him by the circumstances of his theory. As it is, he still retains his conception of the "primary root" as the ultimate source of both sounds $a\flat$ and $f\sharp$.

THE MINOR HARMONY AND MINOR MODE.

As for the Minor harmony and the Minor Mode, Dr. Day merely touches the fringe of one of the most difficult problems connected with the subject of harmony. In the case of the minor harmony $c-e\flat-g$, he tells us that $e\flat$ is an *arbitrary sound* (which, apparently, has strayed into a place where it has no right to be), and in the Tonic discord in the minor mode, he actually substitutes for the minor Third $c-e\flat$, the major Third $c-e\sharp$. In the minor as well as the major mode, then, we find a *major* harmony. Other theorists have regarded the minor as the antithesis of the major mode; Dr. Day demonstrates their identity.

The only form of the Minor Scale which he thinks to be worthy of consideration is the so-called "Harmonic" form, as $a-b-c-d-e-f\sharp-a$. "Here," he remarks, "no major sixth nor minor seventh is to be found; and, strictly speaking, *no major sixth nor minor seventh should be used*. . . . This scale may not be so easy to some instruments and to voices as the old minor scale; therefore, let all those who like it practise that form of passage, but let them not call it the minor scale."¹ Dr. Day evidently intended this as a warning to composers. Unfortunately, by the time Dr. Day's *Treatise* had appeared, much mischief had already been done by composers such as Bach, Handel, Haydn, Mozart, Beethoven, Schubert, Chopin, Mendelssohn, and many others, who not only used other forms of the minor scale, but even treated chords such as $c-e-g$ and $e-g-b$, as if they belonged to A minor. But it is unnecessary to refer to the practice of the great composers. Even on purely theoretical grounds, Dr. Day's views with regard to the minor mode appear inadequate. He makes an arbitrary statement, which is little more than a mere

¹ *Treatise on Harmony*, Pt. I., Ch. 2.

expression of opinion. The difficulty with regard to the ascending and descending Melodic forms of the minor scale cannot be solved by abolishing these forms. The question is a more difficult one than he seems to imagine. At the same time, he is a better theorist than to adopt the easy-going explanation of the harmonic form of the minor scale as arising from a *chromatic alteration* of an old Church mode.

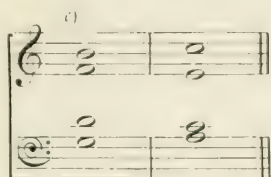
THE SUBDOMINANT : THE AUGMENTED TRIAD.

Another original feature of Dr. Day's theory is his treatment of the Subdominant harmony. We have seen the difficulties which other theorists have experienced in connection with the Subdominant. These difficulties do not exist for Dr. Day. He gets rid of them all by getting rid of the Subdominant itself. The harmony *f-a-c*, in C major, does not, as a matter of fact, represent the Subdominant harmony; that is, *f* is not the "root" of the chord. It is really a part, and indeed, the most dissonant part, of the Dominant discord *g-b-d-f-a-c*. The Subdominant harmony, therefore, is not a concord but a discord, and represents the discord of the Dominant Eleventh. Nevertheless he repeatedly refers to the "Subdominant" as if, in his theory, such a term had any meaning, and he even speaks of a modulation to the *Subdominant key*. If we accept Dr. Day's view, we must regard the following Cadence:—

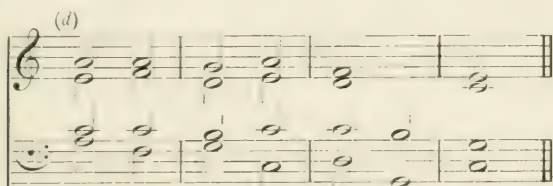


not as a Subdominant-Tonic, but as a Dominant-Tonic succession of chords, in which the bass makes a leap from the *Seventh* of the "Dominant discord" *f-a-c*, to the "root" of the Tonic chord. In the reverse progression (b) the bass makes a leap from the "root" of the Tonic chord

to the Seventh of a Dominant discord. In the Interrupted Cadence (*c*):—

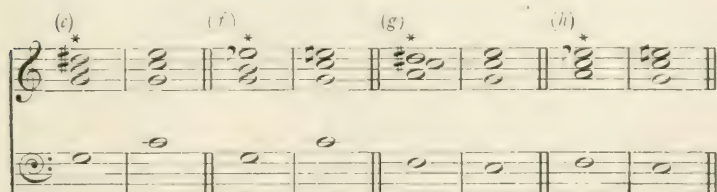


the fundamental bass, the "root," does not move at all; both chords being derived from the Dominant, we have no real succession of harmonies. The second chord is not consonant, but dissonant, and represents the Ninth, Eleventh, and Thirteenth of the Dominant discord. Again, in the following passage (*d*):—



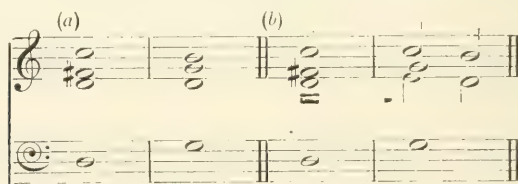
we must not suppose that any real change of harmony occurs; for, except at the final chord, we merely pass from one portion to another of a Dominant discord.

With regard to the Augmented Triad, Dr. Day takes the view that this chord represents the "root," Third, and minor Thirteenth of a Dominant discord. This chord, therefore, should be written not as at (*e*) but as at (*f*):—



This being so, it is surprising that he did not explain the Augmented Sixth chord in a similar way. If Dr. Day's views as to the proper notation of the augmented triad are correct, then beyond all question the correct notation of the chord of the augmented Sixth should be that at (*h*) and not that at (*g*). This chord is now quite easily explained: it consists of the Seventh, major Ninth, Eleventh, and minor Thirteenth of the chord of the Dominant Thirteenth, and resolves quite regularly on the Tonic "root" (!). Dr. Day appears to attach much importance to the fact that $\sharp b$ is a sharper note ($d-d\sharp=24:25$; $d-\flat=15:16$) than $d\sharp$, as if a question which he has shown to hinge on the harmonic determination of a note could be settled by a reference to melodic intonation. But it is quite easy to understand why he should give such an explanation of the augmented triad; for $d\sharp$ does not exist in any of the fundamental discords in C major. He is in short at the mercy of his system.

Of other results of this system, one observes that Dr. Day, while he considers the succession at (*a*) to be in the key of G major, explains that at (*b*) as in C major:—



This is too fine a distinction. Again, we are to believe that in the minor harmony, even that on the Tonic of a minor mode, the Third is an "arbitrary sound."

It cannot be maintained that Dr. Day's system has tended in this country towards a clearer understanding of the nature of harmony. It has tended rather to obscure it. His "natural discords," the majority of whose sounds are foreign to any known harmonic system, are not derived from Nature, but are manufactured by Dr. Day himself; while his treatment of the Subdominant, of the minor harmony and minor key-system, are indefensible. How, then, explain the considerable importance to which Dr. Day's theory has attained, and the

undoubtedly great influence it has exercised on subsequent English writers on harmony? It has been thought that his system of "roots" represents the radical defect and even vice of his theory, and that when his theory of harmony finally disappears, the whole system of "roots" must disappear along with it. This, however, by no means follows. The real defect of Dr. Day's theory lies not so much in his principle of "roots" as in the use he makes of these roots, and of the "fundamental discords" which he builds upon them. One may even venture to assert that it is just Dr. Day's explanation of all harmonies within a key as derived from a simple system of two or three "roots," an explanation in which he allies himself with Rameau, that explains the influence his theory has exercised on musicians.

MACFARREN'S *RUDIMENTS OF HARMONY AND SIX LECTURES ON HARMONY.*

In *Sir G. A. Macfarren*, Dr. Day found an ardent supporter. It was the former's great influence as a composer and teacher, as well as his work *Rudiments of Harmony* (1860) which contributed so largely to the wide dissemination of Dr. Day's theories. In his *Six Lectures on Harmony* (3rd ed., 1882) Macfarren remarks:—"My late friend, Alfred Day, communicated to me his very original and very perspicuous theory of harmony, by means of which many obscurities in the subject were cleared that my previous anxious study had vainly sought to penetrate. . . I am indeed so thoroughly convinced of the truth of Day's theory, and I have derived such infinite advantage from its knowledge in my own practical musicianship, that I should be dishonest to myself and to my hearers were I to pretend to teach any other."¹

The first part of Macfarren's work, like that of Day, treats of "The ancient strict or diatonic style," and the second part, of "The modern style" (Chromatic or free harmony). "The former style," he remarks, "is conventional, limited, and, so to speak, dogmatic; the latter is, in every respect of subject and treatment, natural and free." This is to do a great deal

¹ *Six Lectures on Harmony*, Introduction.

less than justice to the ancient "strict or diatonic" style. But for Macfarren the principal distinction between the "ancient" and "modern" styles is that while the former "allows of no unprepared discords, save only passing-notes," the latter "accepts the natural generation of discords in place of their artificial preparation."¹ Macfarren has not much to say regarding the "natural generation" of concords. But as in the free style we find concords as well as unprepared discords, we must assume that he understood this style to permit of the natural generation of concords as well as of discords. Of the common chords, or consonant triads available in the major key, he remarks:—"There are five common chords available as concords in the major key; those upon the keynote, the subdominant, and the dominant are major; those upon the 2nd and 6th are minor."² In describing the triad on the Supertonic of the major key as a consonant chord, Macfarren overlooks the peculiar character of this chord, and the important part it plays in Rameau's theory of the chord of the Added Sixth. The triad is in fact a diminished one.

As for the common chords on the Tonic and the Dominant, these were doubtless considered by Macfarren to arise respectively from Tonic and Dominant "roots." With regard to the other triads, namely, those on the 2nd, 4th and 6th degrees of the major scale, he does not appear to be disposed, like Day, to explain these as arising from, and as constituent portions of, "natural discords," for, he tells us, they are concords. Macfarren is positive that the triad on the Subdominant is a concord; and he is no less positive that the Subdominant itself is, not as Day explains it, the "natural Seventh" of the Dominant, but a *true* or *perfect* Fifth of the Tonic. He remarks:—"I may recur here to what has already been advanced as to the faculty of the tutored ear for adjusting the prevarications of equal temperament; the 5th of a keynote and of its dominant, or of a keynote and its subdominant are, in the scale of nature, perfectly true in intonation as compared with each other, which is not the fact with any other two diatonic fifths in the same key; equal temperament gives equal imperfection to all intervals in all keys, but the ear accepts for what they should be these exceptionally perfect 5ths in

¹ *Six Lectures on Harmony*, Lecture VI. ² *Rudiments of Harmony*, Ch. 4.

every key, and hears in them what nature would produce rather than what is positively sounded." ¹

It is not difficult to understand the reason for Macfarren's hesitation in accepting Day's explanation of such a chord as that on the Subdominant of a major key, namely, that it represented the 7th, 9th and 11th of the chord of the Dominant 11th: nor is it surprising that he experienced some difficulty in understanding a triad represented by the proportions 7 : 9 : 11 as a consonant chord. Similarly with regard to the chord on the sixth degree. But if Macfarren is not disposed to accept Day's explanation of these chords, he is unable to furnish any other explanation. He presents them to us without telling us whence he gets them, and does not observe that it is necessary to account for them in some way, and especially to explain the origin of the important harmony of the Subdominant.

In demonstrating that the chief and essential characteristic of "modern" harmony is the use of "natural" or unprepared discords, Macfarren does not make quite clear how we should understand the long passages and even complete compositions by modern masters in which there are no unprepared discords, that is, whether we should regard these as belonging to the "ancient diatonic" or the "modern chromatic" styles of harmony. Nor does he sufficiently explain why the mere fact of such discords being, as he alleges, "natural" should justify their being taken without preparation. Is it because the "natural" 7th, 9th, 11th and 13th, all of which are constituent parts of the resonance of the prime tone, have a quasi-consonant character? But Macfarren himself points to at least one unprepared discord in use in "ancient" harmony, namely, that which we know as the first inversion of the diminished triad, as *d-f-b*, where between *f* and *b* we find an augmented fourth. Of the discord in question Macfarren remarks:—"This inverted chord with the diminished fifth was often written by early composers in preference to the dominant as the penultimate chord in a full close; the reasons for the satisfactory effect of which will be best explained when the *true fundamental origin of the chord has been discussed*." Macfarren's explanation of course is that the combination

¹ *Six Lectures on Harmony*, Lecture III. ("The Modern Free or Chromatic Style").

d-f-b is a "natural discord" and an incomplete form of the chord of the Seventh *g-b-d-f*. Here, then, in "ancient" harmony we find a "natural" and "unprepared discord," which, according to Macfarren, is no less than that of the Dominant Seventh itself.

In drawing the distinction he does between the two styles of harmony, Macfarren not only follows Day, but also Fétis, who held that the change from "ancient" to "modern" harmony was effected by means of the introduction into music of an "unprepared discord"—that of the Dominant Seventh. Such conceptions have led to much error and confusion in the domain of the theory of harmony. Although, as we have just seen, unprepared discords were not altogether excluded from "ancient" music, it is quite true that a distinguishing characteristic of modern music is the frequent use of what have come to be known as "unprepared discords." Musicians and theorists have perceived this fact, and without probing the matter further, or inquiring as to whether this really constituted the essential and fundamental difference between the two styles of harmony, they have assumed that the change from "ancient" to "modern" harmony has been effected by means of unprepared discords. The bold and original genius, then, who first in harmonic music introduced an unprepared discord—to him must be ascribed the immortal honour of having accomplished the vast change from the ancient to the modern world of harmony. This genius, says Fétis, was *Monteverde*. Macfarren, however, states that it was not Monteverde, but *Jean Mouton*, who lived about a century earlier, and in whose works occurs the unprepared discord of the Dominant Seventh.¹ But before musicians begin disputing over this matter, it would be wise if they first made quite sure as to whether the great and epoch-making change in question was really owing to the introduction of an unprepared discord, or whether, perchance, it was not the slow, gradual, and consistent development to our present harmonic and key-system which gave such discords their harmonic significance and made them artistically possible.

¹ "It is common to ascribe the discovery and first employment of this chord to Monteverde. . . . There are examples of the unprepared discord of the dominant seventh, however, in the music of Jean Mouton, who lived and wrote a century earlier than he."—(*Six Lectures on Harmony*, Lecture III.)

Although Macfarren is convinced that his "fundamental" discords are derived from Nature, he is nevertheless aware that the "natural" dissonances of the 7th, 11th, and 13th have never actually been used in any system of harmonic music, "ancient" or "modern." "Although there can be no question," he remarks, "of the names of these notes, the universal practice of all singers and players, of all instrument makers, and of all tuners, is to intonate these notes differently from their true harmonic sound."¹ He now actually tells us that this "universal practice" of musicians has been based on a complete misapprehension as to the true nature and intonation of these sounds. "The minor 7th of nature is somewhat flatter, and the 11th somewhat sharper than the notes rendered in musical performance, which from custom the ear accepts as correct, and players on brass instruments, which naturally sound no notes but their harmonics, are obliged to have recourse to some artifice for sharpening the 7th and flattening the 11th, in order to render these notes available for combination with the rest of the orchestra." Still, it does appear strange that in a performance by choir and orchestra, not only the players on brass and stringed instruments, but singers as well, should not make use of these "natural" sounds, when they might easily do so, and should even take considerable trouble to avoid them.

Macfarren has already remarked, quite justly, that in harmonic music a tempered fifth represents to the ear a true or justly intoned fifth. He thinks that the ear acts in exactly the same way with regard to the "natural" sounds of the 7th, 11th and 13th. He dwells with admiration on this "wonderful faculty" possessed by the ear. But in the case of the fifth, there is nothing really wonderful, for it is out of tune only to the extent of the twelfth part of a Pythagorean comma. In the case of the other intervals, however, we find differences of nearly a quarter of a tone (32 : 33). That the ear should take no account of this, and that an interval which is out of tune to the extent of nearly a quarter of a tone should represent to the ear the justly intoned interval, is certainly a wonderful circumstance: so wonderful, indeed, that one may be pardoned for indulging in a little incredulity.

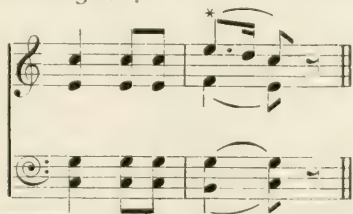
¹ *Six Lectures on Harmony*, Lecture VI.

Other theorists have stated that these natural sounds are "out of tune," and that it is necessary to temper them before they can be employed in music. Macfarren, however, takes the opposite view. These sounds are not out of tune; the fault lies with our singers and instrumentalists, who never give, and never have given them, their correct intonation. In confirmation of this, he remarks:—"That it is an abnormal condition of the musical sense to tolerate, nay, to look for, these qualified 7ths and 11ths—that this condition shows us to be in a state of cultivation, and not a state of Nature—is proved by an interesting passage in Spohr's Autobiography, wherein he gives an account of his observations—and the observations of such a musician compel our respect—of the music of the Swiss peasantry. Every one of you has heard of their custom of calling together their cattle by playing on the horn; every one is familiar with the term *Ranz des Vaches* that defines the melodies they play, whose peculiarity results from their being composed of the harmonic notes of the horn on which they are played. These notes are sounded without sophistication in Switzerland, the horn players there having no regard for the civilised intonation of the orchestra or the drawing-room. Such of the peasantry as do not play regard the notes of the horn as their musical standard, since probably they hear no other instrument; and their ear being thus tutored, they habitually sing their minor 7th *so flat* and their 11th *so sharp* that they would be inadmissible into cultivated musical society."¹

This is a curious passage. Must we infer from it that because the Swiss horn-players, in simple melodies, habitually make the minor 7th flat, therefore intonation in our harmonic music ought to conform to the standard set by the Swiss horn-players? The question, however, is less one of intonation, than of the harmonic significance of sounds and chords. Day and Macfarren do not appear to have attached much importance to Rameau's explanation of the chord of the Dominant Seventh, an explanation which was adopted by Hauptmann. This chord, stated Rameau, was of peculiar significance in our harmonic music, not because it represented the "natural" Seventh, but because it comprised within itself the limits of the key-system, and thus completely defined the key.

¹ *Six Lectures on Harmony*, Lecture VI.

But it is evident that Macfarren's explanations did not convince even himself, and it is probable also that he had reflected on what the result would be if his "natural discords" on the Tonic, Dominant, and Supertonic were actually placed "in tune," that is, according to the natural intonation of their sounds, for still treating of the same subject he says:—"Let us turn from music to the other arts, and we shall find a like disparity between what Nature gives and that which is changed by cultivation. Do we not increase the complexity and diversify the colours of our flowers? Do we not augment the nourishment and enrich the taste of our fruits? . . . Who would be content with a picture that represented its objects with the faithfulness of a looking-glass, without the temperament they receive from the painter's imagination?"¹ This is to put the matter in quite a different light. Whereas, formerly, Nature's intonation of the "natural discords" was the correct intonation, now Nature is taxed with being "out of tune." The cultivated ear is obliged to "temper" the sounds given by Nature. While in the case of the consonances the cultivation of the ear must be directed towards giving these consonances their natural intonation (as Fifth = 2 : 3, Major 3rd = 4 : 5, etc.), in the case of the "natural discords" the cultivation of the ear must be directed towards avoiding the intonation given by Nature; it is necessary to "temper" them, some to the extent of nearly a quarter of a tone. The great importance which attached to the "natural discords" employed in "modern" harmony was owing to the fact that we received these discords directly from Nature. Now it appears that these discords are not derived from Nature at all in the sense understood by Macfarren and Day; and this is nothing but the bare truth. Had Macfarren not been so strongly prejudiced in favour of Day's system of "natural discords" he would not have made such contradictory statements, nor would he have described such chords as the following as chords of the 13th* :—



¹ *Six Lectures on Harmony*, Lecture VI.

With regard to the minor key-system, Macfarren has little to add to the considerations already advanced by Dr. Day. He is of opinion, however, that the principal chord of the minor key-system, namely, the common chord on the Tonic, is properly a minor and not a major harmony; but he is quite unable to inform us whence he has obtained this minor harmony. With regard to the relationship existing between the major and the minor modes, he thinks that the belief entertained by musicians that the third degree of the minor mode is the keynote of its relative major mode, is based on a misconception, and that, in fact, it represents little more than a survival of ancient modal theory. He says:—"The 6th degree of the major key is the keynote of a minor key, which unfortunately is called its relative minor. . . . The relationship of these keys consists in there being more notes in common between them than there are between a major key and any other minor key than its so-called relative; and the relationship is indicated by the two keys having the same signature. There is some analogy to the Ecclesiastical system in the frequent use of the term *mode* when speaking of these qualities of major or minor in a key; it is a remnant indeed of the Church theory to regard the major mode and its relative minor mode as modifications of the same scale—a theory which is opposed to natural truth, and which has consequently sometimes *induced harmonic obscurity in compositions even of the greatest masters.*"¹ Macfarren appears here to insist on the fact that a minor mode and its relative major mode do not have one and the same Tonic, or keynote, but have each its own keynote. In this he does quite rightly. But what does he consider to be the true relative minor of a major mode? It is, he tells us, the Tonic minor:—"It must be understood, then, that the variations of major and minor are modifications of the one same key, not of the two relative keys." That is, the real relative minor of C major is C minor. More than ever, then, the minor mode appears as a modification of its relative major mode. It is a modification, also, to some purpose, for in the minor mode we find three sounds, the minor Third, minor Sixth, and minor Seventh, which are not in the relative major mode.

Macfarren cannot dismiss in this way the actual relationship

¹ *Six Lectures on Harmony*, Introduction.

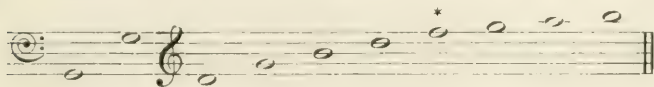
existing between the major and minor modes, as, for example, between A minor and C major, the belief in which, as he himself admits, is "deeply rooted in general acceptance,"¹ nor does he succeed in getting rid of the peculiar difficulties of a problem which has up to the present baffled every musical theorist.

• OUSELEY'S *TREATISE ON HARMONY*.

The *Treatise on Harmony* (1868) of the Rev. Sir F. A. Gore Ouseley, from 1855 until his death in 1889 Professor of Music at Oxford, opens up no fresh ground. We find again the essential features of the Day theory, although in a modified form, while the *System of the Science of Music* of Joh. Bernard Logier (London, 1827) has also, as the author acknowledges, been laid under contribution. Ouseley states that in his work he "has aimed throughout at a consistent theory founded in Nature," and also at "the combination of true philosophical principles with simplicity of explanation."

In Chapter 2 he proceeds to explain the generation of chords. He gives a diagram of the first sixteen "natural harmonics" of the sound C, assumed as an original "root" or "generator," and demonstrates that with the exception of the first six all the others are either octave repetitions of sounds previously heard, or are out of tune; of these latter he remarks:—"These are not only foreign to the key of C, but are *out of tune* in any key," and italicises this statement. The choice of harmonic sounds is therefore limited to the first six; from these we obtain the Tonic chord, c-e-g.

He then gives the first sixteen harmonic sounds of the note g, which is the Fifth of C:—



Here, extraordinary as it may seem, it is unnecessary to call a halt at the number six; in this case we may proceed as far as the tenth harmonic sound. That is, in this case we may avail ourselves of sounds which are

¹ *Six Lectures on Harmony*, Introduction.

not only out of tune, but are "out of tune in any key." Ouseley remarks:—"Here it will be observed that every note belongs to the key of C till we come to the double bar; and, although the note *f*, marked *, is not perfectly in tune, yet *we can substitute a really true f* without at all materially disturbing our new series of sounds."¹ Such methods can scarcely be described as consistent with a "philosophical theory of harmony, founded in Nature."

Ouseley proceeds:—"We obtain, then, the chord *g-b-d-f-a*, which is called the 'dominant chord of Nature,' being based on the fifth of the key." More accurately, this chord should be described as "the dominant chord of Nature, corrected by Ouseley." Ouseley rejects the natural Seventh with which Nature presents him, and substitutes for it a "really true" minor Seventh. In Chapter 5, however, he has changed his opinion, and now considers that the "really true" minor Seventh is the natural seventh harmonic sound, which he has already rejected. "We may regard," he says, "the ordinary minor Seventh as a tempered modification of the fundamental Seventh found among the harmonic sounds of Nature."

But Ouseley brings to our notice another "dominant chord of Nature," the chord of the Dominant minor Ninth, obtained by substituting for the Ninth, *a♯*, the seventeenth harmonic sound *ab*. While *a♯*, he remarks, is perfectly in tune, *ab* is "very nearly in tune." Ouseley therefore does not agree with Day that this *a♯*, the Fifth of the Supertonic, is a comma (80 : 81) too sharp. As for *ab*, this sound differs from a true minor Ninth (1 : 2 + 15 : 16) of *g* by the interval 255 : 256. But as this small interval is almost negligible as compared with the much larger comma 80 : 81, it would seem that the chord of the *minor* Ninth much more truly represents the "dominant chord of Nature."

Ouseley rejects the chord of the Eleventh, as this Eleventh is "too sharp," but does not observe that this leaves him without even Day's Subdominant chord, to say nothing of the harmony on the sixth degree of the scale. As for the chord of the Minor Thirteenth, he is unable to say definitely whether it is a real chord or not. But he is in no doubt as to the chord of the Major Thirteenth; this Thirteenth, he tells us, is "in perfect tune,"² and is represented not as one would

¹ *Treatise on Harmony*, Ch. 2.

² *Ibid.*, Ch. 18.

suppose by the thirteenth harmonic sound from the "root," but by the 27th harmonic sound. This gives a Sixth of the proportion 16 : 27. This Sixth Ouseley evidently considers to be a true major Sixth, and of correct proportion. In reality it differs from a true major Sixth (3 : 5) by a comma, 80 : 81.

Ouseley's views as to the origin of the diatonic major scale deserve notice. The Subdominant, he is of opinion, can only be the principal generator of a new key, that is, the Tonic of the Subdominant key; the original Tonic, then, relinquishes its character as Tonic, and becomes Dominant. By the time the sixth degree of the scale is reached, it becomes necessary to return to the original key "by a modulation to the original tonic"! Strange to say, Ouseley regards such a scale as "a true diatonic scale which begins and ends in the same key."¹

With regard to a Subdominant-Dominant succession of harmonies, we must assume that Ouseley would consider the first chord to be a Tonic chord of the Subdominant key. But indeed he does not appear to observe that the explanation of such a succession is necessary.

With regard to the Minor Mode, the only form of the minor scale which he considers to be deserving of recognition as a real scale is the "harmonic" form. Of the relationship between the major and minor modes, he remarks that "this connection can hardly be said to be of natural origin, inasmuch as the harmonics of the root of the major key do not give us the common chord of its relative minor."² He proposes a new explanation of the minor harmony. "If," he says, "we take the first fifteen sounds of the harmonic series with, for example, C as the root, we find the minor harmony represented by the numbers 10, 12, and 15 of this series. But the root of all the notes in this series is C, not E. C cannot be the root of the minor triad of E. Therefore the numbers 10 : 12 : 15 *do not correctly produce* a genuine minor triad"(!).³ He then extends the harmonic series to the 24th term, and, leaping over all the intermediate sounds, discovers the minor Third of the root C at the 19th term of the series. This sound "gives us the minor third of Nature . . . it is *almost in tune* [!]. . . . Let us, then, assume the fundamental minor Third of Nature

¹ *Treatise on Harmony*, Ch. 4.

² *Ibid.*, Ch. 5.

³ *Ibid.*

to be 16 : 19."¹ The correct proportions of the minor harmony then, should be 16 : 19 : 24. Needless to say, Ouseley's views with regard to the minor harmony have not found much acceptance among musicians. As a "philosophical and consistent theory of harmony" Ouseley's performance cannot compare with that of Dr. Day.

STAINER'S *THEORY OF HARMONY*.

In Sir John Stainer's *Theory of Harmony, Founded on the Tempered Scale* (1871), we meet with a type of work very different from that of Ouseley. Stainer was an original and independent thinker, and it was consistent neither with his vigorous personality, impatience with unreality, nor admirable musicianship, that he should have remained satisfied with works which were passing current in his time as standard works on harmony. In the Preface to his work, he criticizes severely the methods adopted by certain theorists in their manipulation of the harmonic series. "It is interesting," he remarks, "to watch the process. . . . From a few natural harmonics exhibited on a diagram, about a dozen of the hundreds of chords in use are constructed; the insufficiency of the number of the chords being then too apparent, Nature is taxed with being out of tune, and tempered intervals are introduced to allow of the construction of some of the most ordinary chords in music." In discarding, then, the harmonic series, he points to the impossibility of constructing a rational theory of harmony on a mathematical basis. He says:—"When musical mathematicians shall have agreed amongst themselves upon the exact number of divisions necessary in the octave, . . . when practical musicians shall have framed a new system of notation which shall point out to the performer the ratio of the note he is to sound to its generator, when genius shall have used all this new material to the glory of Art—then it will be time enough to found a Theory of Harmony on a mathematical basis."

It is, then, on the *tempered* and not on any mathematically correct scale, supposing that such a scale could be found, that Stainer proposes to base his new theory of harmony. It is

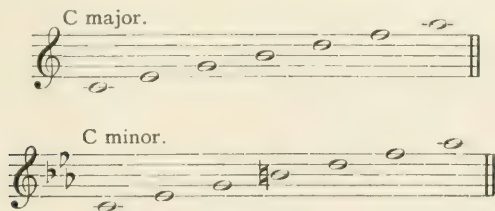
¹ *Treatise on Harmony*, Ch. 5.

true, he remarks, that "the tempered scale is out of tune, and will not bear to have its proportions exhibited to an audience with better eyes than ears; but its sounds have nevertheless been a source of as real pleasure to all great composers, as of imaginary pain to certain theorists."

We must assume, then, that Harmony has its source in Melody. "Melody existed before Harmony. . . . A Chord, therefore, is defined as a combination of notes taken from a scale, or sometimes (but rarely) from two closely-allied scales." On what principle, then, are melodic notes combined so as to form chords? "It is," says Stainer, "simply this: by adding Thirds together, the Thirds being major or minor according to their nature in the scale from which they are taken. Until the interval of a Third," he proceeds, "is allowed to be the basis of all harmony, no theory of music can possibly be formed which will be true to facts. The old veneration for the perfections of the Fourth and Fifth, hardly yet extinct, helped to degrade Thirds by calling them imperfect intervals. . . . If any interval ever deserved to be called perfect, it is the Third."¹

ADDED THIRD GENERATION OF CHORDS: THE TEMPERED SCALE.

"The simplest and most natural way of arranging chords," then, "is evidently to begin with the tonic, and to go on adding thirds from the scale, until the whole of the notes of the scale are exhausted."² In this way, starting with the common chord formed by adding two Thirds together, we obtain, by means of the addition of a third Third, a chord of the Seventh, and so on until we finally arrive at a chord of the Thirteenth:—



¹ *Theory of Harmony Founded on the Tempered Scale*, Ch. 3. ² *Ibid.*

Such a series of Thirds, starting from the Tonic, may be derived not only from a major scale but from a minor scale. It will be observed that Stainer does not, like Day, consider himself at liberty to place a major triad on the Tonic of the Minor Mode.

But it is not only on the Tonic that such a structure of Thirds may be raised. The Dominant also may be selected as a starting point. Thus from the Dominant of the major scale there arises the series *g-b-d-f-a-c-e*, and from the Dominant of the minor scale the series *g-b \flat -d-f-a \flat -c-e \flat* . Stainer then proceeds to show how various chords are derived from these structures of Thirds. Such, in brief, are the main lines on which he draws up his theory.

After Stainer's demonstration of the futility of deriving harmony from the harmonic series, of the impossibility of arriving at a clear understanding with regard to what scales ought to be considered as acoustically correct, and in general of founding a theory of harmony on a mathematical basis, but especially after the inference he has drawn in connection with his statement that it is the tempered scale from which has been derived the harmonic material of the great composers, one is not quite prepared for his frank admission that the tempered scale is "out of tune." How out of tune? And out of tune with what? Is it out of tune with the oldest and original type of the diatonic scale, the scale of Pythagoras; this scale which was in use not only among the Greeks but throughout the whole of the Middle Ages? Compared with this venerable scale which, dating from Greek antiquity, was still in use till near the dawn of the Renaissance, our modern scales are of mushroom growth. If Stainer's views as to the nature of harmony are correct, it is this scale which we ought to regard as the real foundation of European music and European harmony. The only drawback to such a view is that this old scale, with its Pythagorean tuning and false Thirds, was, during the development of polyphony, ultimately discarded, the reason being that it could not produce a true major nor a true minor harmony. This is surely an extraordinary circumstance for those who hold that Harmony arises from Melody. What did these musicians want with a true major or minor harmony? Where did they acquire the foolish notion that such a harmony existed, or could possibly exist?

And why should they not have remained satisfied with the harmony which their scale offered to them?

Nevertheless this new harmony, what Zarlino called the "*Harmonia perfecta*," arrived, whence no one very well knew,—apparently from the clouds—and brought about a musical revolution of which we are to-day reaping the fruits, and of which our whole modern harmonic art is the direct result. Instead then of the scale determining harmony, we actually and before our eyes find harmony determining the scale.

But it is not, of course, the Pythagorean scale with which Stainer compares his tempered scale, nor would he propose for a moment to hold up this scale as the true foundation of harmony. What Stainer means, and knows quite well, is that with the exception of the Octave every interval in the tempered scale differs slightly from its acoustical and mathematically correct determination. For example, the Fifth, as *c-g*, is flatter by the twelfth of a Pythagorean comma ($524288 : 531441$)—more or less, according to the experience and skill of the tuner—than the perfect Fifth ($2 : 3$) which arises in the harmonic series immediately after the Octave.

The alarming thought then suggests itself—could the tuner, without this acoustically determined Fifth, possibly present us with a tempered Fifth? The answer must be in the negative. Even the tempered scale then is dependent on harmony! Stainer is now in possession of two acoustically perfect intervals,—the perfect Octave, which not even a tempered scale can dispense with, and without which the limits of the scale could not be defined, and the perfect Fifth. The ratio of this octave is $1 : 2$, and of this Fifth $2 : 3$. But although Stainer does not believe in "generators" or "roots," he believes nevertheless, like every theorist who tells us that harmony arises from melody, in the inversion of intervals and of chords. The inversion of the perfect Fifth, then, gives him the perfect Fourth, the ratio of which is $3 : 4$. Further, as the Third, according to Stainer, is the primary and most perfect constituent of harmony, we must include both the major and minor Thirds. Stainer knows, and says, that in the tempered scale both these intervals are out of tune, that is, they *stand for* or represent true major and minor Thirds. The ratios of these intervals are respectively $4 : 5$ and $5 : 6$. Collecting these results, we find that the harmonic material of which Stainer is obliged to avail himself

is all mathematically determined, and that it is all comprised in the arithmetical series $1 : 2 : 3 : 4 : 5 : 6$.

This is not a bad beginning for a theorist who has set out to demonstrate the impossibility of founding any rational theory of harmony on a mathematical basis. Stainer, indeed, succeeds in demonstrating the impossibility of dissociating his theory of harmony, based on the tempered scale, from the acoustical determination of the intervals which form the constitutive elements of harmony.

Stainer's idea that the scale is the basis of all music and all harmony is not new. The same theory had been promulgated by Fétis and others. Fétis, as we saw, considered that the fundamental law of all music was *Tonality*, and that tonality was the result of the arrangement of the sounds of the scale. We saw that Fétis experienced considerable difficulty in deducing definite principles of harmony from the mere arrangement of sounds of the scale; he arrived, by some unknown means, at the discovery that certain sounds in the scale possessed the character of repose. These sounds proved to be nothing more nor less than the sounds of Rameau's fundamental bass in Fifths. Fétis, however, had to admit other sounds of the scale as being also sounds of repose: and might also have pointed out that his sounds of repose became sounds of unrest, or movement, and conversely his sounds of unrest, sounds of repose, according to circumstances.

It is interesting, then, to observe what success attends Stainer's efforts to deduce definite principles of harmony from the tempered scale. His theory is at least simple and straightforward. If he is less subtle than Fétis and other theorists whose works we have been examining, he does not try to entertain two entirely contradictory and irreconcilable propositions at one and the same time, nor does he use language designedly ambiguous, and calculated to provide the theorist with an avenue for escape should the suggestions he has thrown out prove to be untenable. Stainer's fundamental principle of harmony, his principle of principles, is simplicity itself, namely, that all harmony is the result of Thirds added together.

How does Stainer arrive at such a conception of harmony? It is certainly not the result of his study of the tempered scale. There is nothing in the tempered scale which even suggests such a principle; rather, the contrary is the case. For, as

Rameau maintained, the scale is comprised within the limits of an Octave. If now the scale has anything to teach us with regard to the formation of chords, it teaches first of all that no chord must exceed the compass of an Octave. But of course there is no difficulty in discovering whence Stainer has derived his fundamental principle of harmony. He has borrowed it from Day and the other theorists who make use of the harmonic series for the generation of chords.

THE THIRD THE "BASIS OF ALL HARMONY."

Stainer does not, like Fétis, attach great importance to the harmonic significance of the *Fifth*. It is the Third which possesses real generative power. On this point he is quite definite. "Until the interval of a third," he has said, "is allowed to be the basis of all harmony, no theory of music can possibly be formed which will be true to facts." But no sooner has Stainer proceeded to form chords by adding Thirds together than certain facts of the utmost importance arise, which he seems not to have observed, much less considered. The first chord he obtains is that of the major harmony *c-e-g*. This chord, Stainer says, is formed by adding together the two Thirds *c-e* and *e-g*. Stainer knows that the second Third ought to be minor, and not major, as *e-g#*, because this *g#* does not belong to the key of C.

But what Stainer fails to observe is that, having added his two Thirds together, there results quite another interval, namely, the Perfect Fifth *c-g*. He does not pause to consider whether this Perfect Fifth may not possess quite as great a theoretical significance as the Third; whether it might not be more correct to explain the two Thirds as arising from the *harmonic division* of the Fifth, rather than the Fifth as arising from the *addition* of the Thirds; and whether it is the scale which determines the order of sounds and qualities of the intervals in the harmony *c-e-g*, or whether, perchance, it might not be the harmony *c-e-g* which determines the nature and character of the scale. Stainer does not speak of the chord of the Dominant Seventh as "a chord of three Thirds," but calls it of course a chord of the Seventh. In this chord we find not only major and minor Thirds, but a diminished and a perfect Fifth, as well as a minor Seventh.

Again, why does Stainer select the Dominant, in addition to the Tonic, as a basis for the formation of chords? Between Tonic and Dominant we have the interval of a Fifth, an interval which, according to Stainer, is of little theoretical significance. Why then for his second "root" does he select the Fifth, and pass over the Third, seeing that "the Third is the basis of all harmony"? Why also does he build his chords upwards, rather than downwards? Does he look on the descending scale as something theoretically inadmissible? In short Stainer, although he discards the harmonic series, finds it impossible to get rid of the idea of a fundamental note, root, or generator. It clings to his theory from start to finish; and one is not surprised to read, at the "Conclusion" of his work, the following statement:—"All discords, even of the most complicated kind, are as it were built round a common chord," and that "the *fundamental note* of this common chord is the note from which the whole chord is said to be derived—or, its *ground-note, or root.*"

This is a somewhat belated confession; a statement which Stainer ought to have placed at the beginning, not at the end of his work. In what sense does Stainer use the terms ground-note or root? Does he consider that in his chord of the Dominant Thirteenth all the sounds of which it is composed are "derived from" the Dominant?

DISCORDS WHICH ARISE FROM THE TEMPERED SCALE.

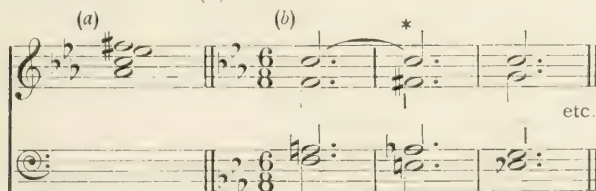
When Stainer comes to apply his principles to examples of harmony by the great composers, his theory, as might be expected, completely breaks down. At (a) we find one of those discords which Stainer describes as being "built round a common chord":—



The common chord, in this case, appears to be the Subdominant Chord in $E\flat$ major, namely $a\flat-c-\flat$, and the discord in fact is that of Rameau's "Added Sixth." But this, according to Stainer, is quite a wrong explanation. The common chord round which this discord is built is not the Subdominant, but the Dominant harmony $b\flat-d-f$, and the discord itself is "the third inversion of the chord of the Eleventh of $B\flat$ "; that is, it is not a Subdominant, but a Dominant discord. Neither the root nor Third of this chord of the Eleventh is present. Such being the case, ought we not likewise to consider the chord of the Dominant Seventh, $g-b-d-f$ as, in reality, a chord of the Tonic Eleventh, $c-c-g-b-d-f$, with the "root" and Third omitted?

The chord at (b) is described by Stainer as a chord of the Dominant Thirteenth in C major. In this case a gap occurs between f , the third Third of the chord, and e , but all that is necessary is to keep on adding Thirds until we arrive at the latter sound. Stainer does not describe e as the sixth Third of the chord, or as the Third of the Tonic, but as the Thirteenth of the Dominant. It would be more easily understood as the Sixth of the Dominant; but an insuperable objection towards regarding it as a Sixth is that its real origin—which is that of added Thirds—would be rendered obscure. Nevertheless, we must believe that this chord of the Thirteenth has its basis in the tempered scale.

The chord of the Augmented Sixth Stainer considers to be derived "from two scales," therefore from two keys. Thus the chord at (a) "consists of the minor ninth of the dominant (g), with the major third, minor seventh, and minor ninth of the second dominant (d)":¹—



This is also Day's explanation of this chord. Both theorists are evidently quite satisfied that the sounds c and $e\flat$,

¹ *Theory of Harmony*, Ch. 8.

of this chord, cannot possibly be considered as the Eleventh and Thirteenth of the Dominant *g*. But it is by no means clear why *ab* should belong to one key, or "root," and *c* and *eb* to another : especially as all three sounds give us the major harmony *ab-c-eb*. Still another peculiar formation is that at (*b*). This chord, Stainer says, is composed of the tonic C, its *major* (!) third E, *A \flat* the minor ninth of the dominant G, and *F \sharp* the major third of the second dominant D.

As Stainer takes as his starting-point the tempered scale, he does not consider it necessary to enter into the question of the nature and origin of the scale. Only, in the chapter on "Modulation," he states that the major scale is in two keys. Thus, in the scale of C major, the lower tetrachord is in F major, and the upper tetrachord in C major. It results from the nature of Stainer's theory that the section of his work treating of *Modulation* and *Chord Succession* is quite inadequate. Like Day, he has no explanation to offer of the minor harmony and the minor mode, nor does he seem to recognise their peculiar difficulties, making use only, for purposes of chord formation, of the "harmonic" form of the minor scale.

PROUT'S "HARMONY : ITS THEORY AND PRACTICE."

Finally, mention may be made of Professor Ebenezer Prout's *Harmony : Its Theory and Practice* (1889, 20th ed. 1903). In Prout's work we find the Day theory again in full vigour. Briefly stated, Prout's theory is as follows :—The selection of certain sounds of the scale, major or minor, as roots or generators ; the building up of chords by means of added Thirds ; and the arbitrary selection for this purpose of sounds from the harmonic series. It is true that Dr. Day, even if he had perforce to make use of added Thirds as a principle of harmonic generation, nevertheless avoided making too definite a statement on this point, and especially as to exactly what sounds of the harmonic series he considered it necessary to make use of for the purposes of chord formation. Prout, however, is much less cautious than the older theorist. He states plainly :—
" Every chord is made by placing not fewer than three notes

one above another at an interval of a Third"; and tells us also exactly what sounds he selects from the harmonic series.

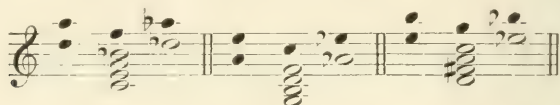
Starting with a major harmony, as *c-e-g*, in which *c* is the root, Prout has evidently no difficulty in deciding that the next Third to be added must be a minor Third. The seventh sound of the harmonic series provides him with a Third of the proportion 6:7. This, however, is not the minor Third required. Prout therefore substitutes for this seventh harmonic another and sharper sound, which will give him the Third required. Nevertheless, curiously enough, Prout considers that this new sound (*b♭*) has been derived from the harmonic series. We have now the chord of the Tonic Seventh *c-e-g-b♭*.

"When we come to add another Third above the Seventh, a choice offers itself. We can either take a minor 3rd (*D♭*, the 17th harmonic) or a major 3rd (*D♯*, the 9th harmonic)."¹ Prout takes both, and thus obtains a chord of the Tonic Minor Ninth, *c-e-g-b♭-d♭*, as well as a major Ninth, *c-e-g-b♭-d♯*. The next Third must be a minor one. The eleventh harmonic is much too sharp to represent the new sound *f* which is required; it must therefore be rejected, and we must select in its stead the 21st harmonic sound, which is much better in tune. We have now the chord of the Eleventh *c-e-g-b♭-d-f*. If now, we add to this chord a major third, we shall have a chord of the major Thirteenth; and, if a minor Third, a chord of the minor Thirteenth. The new major Third *a* cannot be represented by the 13th harmonic sound of *C*, because it is much too flat; we therefore take, instead, the 27th sound of the harmonic series of which *C* is generator, this sound being "much better in tune." As for the minor Third *a♭*, this is represented by the 51st sound of the harmonic series. Prout also describes this sound as the "17th harmonic of the dominant," which of course means nothing, as he is developing his complete chord from the Tonic root.

"Having exhausted the available harmonic resources of *C*," he proceeds, "as a fundamental note, we must look elsewhere for the materials to complete our key." He therefore takes *G*, the Dominant, and *D*, the Supertonic, for "roots," as well as *C*, and, following Dr. Day, places on these sounds a chord similar to that which he has considered to be developed from

¹ *Harmony: its Theory and Practice*, Ch. 3.

the Tonic. He is now in possession of all the harmonic material he requires:—



All this, apparently, we must understand as "the theory or science of harmony." But anything more unscientific, more opposed to common-sense even, it would be difficult to imagine. Such a theory only requires to be stated to convince any discerning mind of its absurdity. Anyone is at liberty, if he so desires, to build up huge sound-combinations by means of adding Thirds to one another; anyone may, from a harmonic series extended to the 51st term, pick out whatever sounds he may please, but why describe this as the science of harmony? What Prout does is as follows:—He proposes to be guided by Nature, and to derive from the sounds of the harmonic series the harmonic content of the key-system. He does not however take the sounds of the harmonic series as they arise in Nature, but in a quite arbitrary way selects those sounds which he considers necessary for his purpose. But even the sounds thus selected are, it turns out, for the most part "out of tune." He is therefore obliged to reject them, and as a matter of fact does not make use of them at all. Here then, one would imagine we have the end of the whole matter. Nevertheless, Prout presents to us certain huge combinations of sounds which he describes as "natural discords." Most wonderful of all, he is of opinion that he has derived these monstrous structures from the sounds of the harmonic series!

ABANDONMENT OF THE HARMONIC SERIES AS THE BASIS OF HARMONY.

Origin of Discords: the Subdominant.

In 1901 Professor Prout published what is best described as a new work on harmony. In this work he has considerably modified his previous theories, and introduced many changes. "First and foremost among these," he remarks, "is the

virtual abandonment of the harmonic series as the basis on which the system is founded." He is now of opinion that "the modern major or minor is largely the result of æsthetic, rather than of scientific considerations."¹ Having abandoned the harmonic series, Prout, indeed, is quite unable to find any scientific basis for the theory of harmony. He does not state whether he considers that "æsthetic considerations" form a suitable basis for such a theory. It is necessary to suppose that he has a basis of some sort, for his new work bears the title, *Harmony : its THEORY and Practice*.

But it does not appear that Prout has any real foundation for his theory, or that his work can properly be described as a *theory* of harmony at all. He makes no serious attempt to grapple with those important questions which Rameau rightly considered to constitute the central problems of the theory of harmony; such as the nature and origin of the key-system, of the major scale, of the minor scale (or, more accurately, scales), of the major harmony, of the minor harmony, of the generation of discords, of the relationship between the major and minor modes, of chord succession, etc. It is not sufficient to state that all these things are based on æsthetical considerations.

Prout altogether discards the "fundamental discords" of the Tonic and Supertonic, while retaining that on the Dominant. But of this chord of the Dominant Thirteenth he can give no adequate explanation. Of the chord of the Dominant Seventh he remarks:—"We meet here for the first time with a 'fundamental discord,' that is, a discord composed of the harmonics of the fundamental tone, or generator."² But the discords of the Dominant Ninth, Eleventh, and Thirteenth, do not admit of a similar explanation. "Further investigation and thought," Prout states, "have convinced the author that the practical objections to the derivation of the higher discords—the Ninths, Elevenths, and Thirteenths—from the natural series of upper partials were far greater than he had realised."³ While, then, the discord of the Dominant Seventh is a "natural" and "fundamental" discord, those of the Ninth, Eleventh, and Thirteenth of the Dominant are not. This is not easy to understand.

¹ *Harmony : its Theory and Practice*, New Edition, Preface.

² *Ibid.*, Ch. 8.

³ *Ibid.*, Preface.

Day explained these discords as differing from every other class of discords in that they did not require preparation; and the reason he assigned for this was that they had a natural origin, and arose from the harmonic series. It is difficult to understand why Prout should admit the Seventh as a harmonic sound, and exclude, for example, the Ninth. The Dominant Ninth requires preparation almost as little as the Dominant Seventh. Besides, this Ninth is more "in tune" than the Seventh. While the latter is flatter than the fourth degree of the major scale by the interval 63 : 64, the former is only a comma (80 : 81) sharper than the sixth degree of the scale.

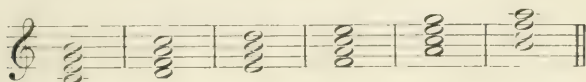
Prout makes a notable advance in his recognition of a *Subdominant*. In his previous work he had as in most other things followed Day, who, while retaining the name Subdominant, and recognizing the possibility of a modulation to the Subdominant *key*, had nevertheless explained the Subdominant as part (Seventh, Ninth, and Eleventh) of a Dominant discord, and as having a Dominant "root." Prout now states that there are three Primary Triads in every key, namely, the Tonic, Dominant, and Subdominant triads. He goes further in the direction of Rameau's theory:—"The three primary triads," he says, "absolutely define the key."¹ In explanation of this he remarks:—"The only notes which make perfect consonances with C [the Tonic] are the dominant G [a fifth above] and the subdominant F [a fifth below]. The tonic, dominant, and subdominant are *therefore* called the three Primary Notes of every key."² This however, by no means follows; nor does the mere fact of the two Dominants being perfectly consonant with the Tonic furnish a sufficient explanation as to why the three primary triads absolutely define the key.

¹ *Harmony: its Theory and Practice*, New Edition, Ch. 4.

² *Ibid.*, Ch. 2.

SECONDARY DISCORDS.

Prout, however, still retains his extraordinary theory as to the origin of what, in his former work, he describes as "diatonic discords," and now as "secondary discords." If above each of the triads which may occur on each degree of the major scale—the Dominant, however, excepted—we place a Seventh in accordance with the key-signature, we obtain all the secondary chords of the Seventh which belong to a major key: thus:—



All these chords, according to Prout, are derived from Dominant discords of the Ninth, Eleventh, or Thirteenth. Thus the Tonic chord of the Seventh "consists of the Eleventh, Thirteenth, root, and Third of the Dominant Thirteenth" ¹; that on the Subdominant is a "derivative" of the same Dominant discord (7th, 9th, 11th and 13th), and the other chords are explained in a similar way.² But with regard to the Tonic Seventh *c-e-g-b*, one would naturally suppose that the harmonic foundation of this chord is the Tonic chord *c-e-g*; and that in the case of the Sub-dominant Seventh the foundation of the chord is the Sub-dominant harmony *f-a-c*; especially as these secondary chords of the Seventh on the first and fourth degrees of the scale have been formed by the addition of a Seventh above the Tonic and Subdominant harmonies.

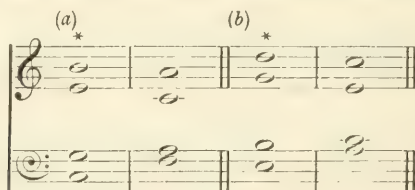
This however, according to Prout, is not the case. The sounds *c-e-g* and *f-a-c* must here be understood as being derived from the *Dominant*. It appears, then, that while the chord *c-e-g* has as its generator the Tonic, the generator of the chord obtained by adding a Seventh above the Tonic harmony is not the Tonic, but the Dominant. And similarly with the chords *f-a-c* and *f-a-c-e*.

But notwithstanding that the secondary chords of the Seventh have their origin in Dominant discords, we must not,

¹ *Harmony: its Theory and Practice*, New Edition, Ch. 14.

² *Ibid.*

says Prout, consider them to represent such Dominant discords. "Notice," he remarks, "that in none of these chords is the characteristic interval of a fundamental discord—the diminished fifth between the major third and minor seventh—to be seen."¹ He even thinks that in practical composition the origin of these chords should be quite disregarded. "With all these secondary Sevenths," he says, "the student has not to concern himself in the least with the relationship of the various notes of the chord to the dominant, but only with their relations to each other." This is, doubtless, good advice. For example, in the following succession of chords (a):—



we find that the bass note in the first chord which, according to Prout, is the Eleventh of the Dominant *g*, leaps a Fourth upwards to what we must suppose to be its note of "resolution." Similarly, in the first chord of example (b) the bass note in the first chord, which is the Thirteenth of the Dominant, "resolves" by rising a Fourth.

But the most remarkable of all these "Dominant discords" is that on the Submediant, *a-c-e-g*. Here the generator *g*, the Dominant, is at the top, while the Ninth *a* is at the bottom. It is not the Ninth, however, which requires to be resolved, but the generator itself. The Ninth, on the other hand, while the generator descends a degree to its note of resolution, may rise a Fourth, or fall a Fifth. Strange to say, Professor Prout is not only aware of these circumstances, but points them out. He remarks:—"In the Chord VI.₇ (*a-c-e-g*) the root of the chord (*a*) is the ninth of the Dominant, and the Dominant (the generator) is the seventh. But it is not the Ninth which is restricted in its movement by the presence of the Dominant, as in a chord of the Ninth; it is the Dominant, which has now become the seventh of the chord, that is itself restricted by the presence of the root below." (As is known,

¹ *Harmony: its Theory and Practice*, New Edition, Ch. 14.

Professor Prout draws a distinction between the "root" and the "generator" of a chord. He describes as "root" the lowest note of any chord consisting of a series of Thirds. While therefore *a* is the "root" of the chord *a-c-e-g*, the "generator" is not *a* but *g*.)

It is difficult to understand why Prout, in the face of these facts, and without even being able to furnish any adequate explanation of the Dominant discords themselves, should go to such extraordinary lengths to explain the secondary chords of the Seventh as derived from Dominant discords. Is it because he is unable to find any explanation of the secondary *triads* of the key-system?

CHORD SUCCESSION: "TONALITY" AND THE "MELODIC TENDENCIES" OF SOUNDS.

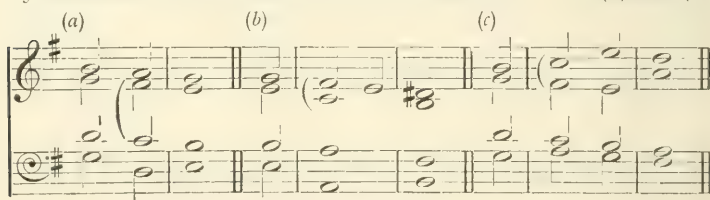
Prout now finds himself unable to explain even such a simple succession of chords as that of Dominant followed by Tonic harmony. In his previous work he had been able to furnish a quite adequate explanation of this succession, borrowing from Dr. Day the explanation which the latter theorist had in his turn derived from Rameau, namely, that in the Perfect Cadence the Fifth returns to its "root" or source.

He adopts, it is true, theoretical ideas from various quarters. He identifies himself with the somewhat lame, certainly inadequate explanation of Fétis, of the tendency of the chord of the Dominant Seventh towards the Tonic chord.¹ It is, he says, the interval of the diminished Fifth which determines the resolution of this discord. Prout appears to be of opinion that the only natural resolution of the diminished Fifth, or of its inversion, the tritone, is that on the "root" and Third of the Tonic chord. On the contrary, these intervals may resolve in various ways. For example, the tritone *f-b* may resolve in a perfectly natural way on the perfect Fifth *e-b*; from the point of view of the resolution of dissonance, the resolution *e-b* is better than the resolution *c-c*. For, in the first case, one note remains while the other moves, while in the second, both notes move to the notes of resolution. Also, in the first case, the interval of resolution is a perfect Fifth,

¹ See remarks on Fétis's theory, pp. 343-345.

while, in the second case, it is a minor Sixth, an interval described by Helmholtz as the worst of the consonances.

The theoretical value of Prout's newly acquired notions respecting "Tonality" and the "melodic tendencies" of the sounds of the scale, we have already ascertained in our examination of the theory of harmony of Fétis. Prout has nothing very definite to state with regard to what the melodic tendencies of the sounds of the scale really are. He does, it is true, make a definite statement to the effect that the general rule to be observed is that, "two notes forming a diminished interval have a tendency to approach one another," while, on the other hand, "two notes forming an augmented interval have a tendency to diverge."¹ But it is evident that this "rule" is insufficient. For if we resolve the tritone *f-b* on the Octave *d-d'*, we find that, while the notes of the tritone diverge, we do not obtain the resolution required by Prout. His rule requires to be supplemented to the effect that the notes forming the dissonant interval should, in resolving, proceed by the step of a tone or semitone. But it is to be feared that this "rule," if it be a rule, is honoured as frequently by musicians in the breach as in the observance. At (a) and (b)



we find an augmented interval which does not diverge in resolution, while at (c) we find a diminished interval which does not contract. It cannot be contended that there is anything strained or unnatural in these harmonic successions. Many others of a similar kind, which are constantly being used in harmonic music, might be quoted.

Still, one need not seriously object to Prout's "rule" except that it suffers so many exceptions, and that it does not inform us how to treat other intervals which are neither augmented nor diminished, but principally that considered as a principle of "tonality" it forms such a meagre and

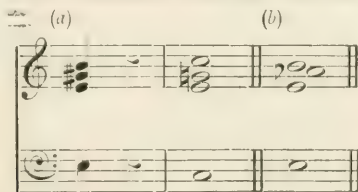
¹ *Harmony : its Theory and Practice*, New Edition, Ch. 8.

insecure basis for any adequate theory of harmony. But of course the resolution of dissonance is determined not by any "melodic tendencies," real or imagined, of the sounds of the scale, but by harmonic considerations. In the following well-known passage from the *Prelude* to Wagner's *Tristan*,



we see the process going on under our eyes. First $g\sharp$ proceeds to a , thus forming the familiar chord of the Augmented Sixth, then $a\sharp$ proceeds to b , the Fifth of the chord of the Dominant Seventh $c-g\sharp-b-d$. It might be assumed that Wagner's harmonies represent nothing more serious than a simple diatonic succession of chords, modified and "ornamented" by means of sounds which possess merely a melodic, but no harmonic significance, *i.e.*, "chromatically altered" notes, and a few auxiliary and passing-notes. But even if we eliminate $g\sharp$ in the second bar, and $a\sharp$ in the third, there still remain the chords of the augmented Sixth and Dominant Seventh. Must we believe that several of the sounds in these chords have no real harmonic significance?

An extremely curious instance of the strange manner in which Prout jumbles together his new ideas on the melodic tendencies of sounds with his old theory of fundamental discords, is his explanation of the major harmony on the third degree of the major scale, which is followed by the Tonic harmony. He has evidently some difficulty in understanding how $g\sharp$, in the first chord, can proceed to $g\flat$ in the second. He therefore rewrites the chord as at (b):—



Here, instead of $g\sharp$, we find $a\flat$, which as a downward leading-note may now resolve quite regularly on g . But the chord at (b), he remarks, is derived from the Dominant Thirteenth: e is the Thirteenth; b is the Third, while $a\flat$ is a chromatically altered Ninth. "The note e belongs to c major, while $a\flat$ is borrowed from c minor."¹ Prout, therefore, like Riemann, turns what is most decidedly a harmonic triad, or major harmony, into a discord.

In short, as an exponent of the doctrine that chord succession is to be explained as resulting from the "melodic tendencies" of the sounds of the scale, Prout meets with as little success as those from whom he has borrowed his ideas. He has cast overboard the harmonic series, he has no longer the guiding hand of Dr. Day, whose theory in his previous work he had closely adhered to, and he is now as it were groping in the dark, and totally unable to formulate any independent theory of his own. One can scarcely avoid concluding that Prout, to repeat the remark already made in connection with the practical works on harmony, of Weber, Schneider, Albrechtsberger and others, had abandoned his belief in the possibility of any theory of harmony which attempts to co-ordinate or systematize the harmonic facts, and that he had formed the opinion that the best work on harmony is that which takes account of the largest number of these facts, and treats of them in a practical way. But it was just the existence of such a multitude of isolated facts, apparently without connection with each other, which was the occasion of Rameau's attempts to introduce some order and system into the domain of the theory of harmony.

¹ *Harmony: its Theory and Practice*, New Edition, Ch. 18.

CHAPTER XIV.

RÉSUMÉ AND CONCLUSION.

WE have now concluded our examination of the most important works treating of the science of harmony by the theorists who followed Rameau. The list has not been complete, but of the works which have been omitted some cannot properly be described as theories of harmony, while others are for the most part merely text-books of figured bass and composition. In our examination of the works of Rameau, we found that Rameau derived his fundamental principle of harmony from Zarlino and Descartes.* Both of these distinguished men had pointed out, as a fact of the first importance for musical theory, that all the consonances, all the positive constitutive elements of harmony, arose, not arbitrarily, but according to a certain definite mathematical principle, namely, that of the "*senario*" or arithmetical progression $1 : 2 : 3 : 4 : 5 : 6$. From this "natural" principle of harmony Rameau developed his theories of the Fundamental Note in chords, Generation of chords, Harmonic Inversion, the Fundamental Bass, and Chord Succession: harmony in all its manifestations had, he contended, its source in this mathematical principle. Later Rameau became aware of the fact that the major harmony, resulting from the union of all the sounds represented by the proportions of the *senario*, actually existed in Nature as a physical fact. Musical sound contained within itself those natural divisions, and in its resonance the actual sounds, represented by the proportions of the *senario*. This Rameau considered to be not only a wonderful circumstance in itself, but also a remarkable confirmation of the truth of his theories.

We found, however, that Rameau had not proceeded far in the development of his theories before he encountered serious difficulties. That several of the essential features of his theory did not wholly satisfy him is proved by the fact that he frequently changed his views respecting them; such were his theories of the origin of the Subdominant, of the origin of the minor harmony, of the generation of chords, of the relationship between the major and the minor modes, of the fundamental bass in Thirds. Other difficulties he either did not perceive, or did not fully appreciate. We found that Fétis, Berlioz and others advanced objections against Rameau's or any other attempt to relate the theory of harmony to acoustical phenomena, or to discover for it a physical basis. They pointed out that if Rameau was justified in considering the resonance of certain sonorous bodies to constitute the "natural principle" of Consonance, he was bound to consider also such resonance to be a natural principle of Dissonance, for even in the sounds of the harmonic series not only consonances, but dissonances, are to be found. Further, that if Rameau was justified in deriving the major harmony from the resonance of strings, organ pipes, and other similar bodies, he was unable to derive the minor harmony from the same source; on the other hand, he took no account of the many other sonorous bodies which were in existence, capable of producing "natural discords" of various kinds. Berlioz concluded that in respect of music and harmony, the ear was the sole judge. Musical intervals and chords were determined not by any natural acoustical law, but solely according to the impressions they made on the ear; while Fétis contended that music had nothing to do with anything external to man—harmony existed in and for itself, and in his music-making man enjoyed and exercised to the full his "philosophic liberty."

The objections of Berlioz and Fétis, however, we found not to be of the most serious kind. It is quite futile to assert that consonance, to which we may relate the phenomenon of beats, has nothing to do with natural acoustical law. While it is true that in respect of harmony, of consonance and dissonance, the ear is the principal judge, it is not true that the ear is free to choose the sound which it may regard as consonant. For a similar reason, all the "philosophic liberty" enjoyed by the musician

does not enable him to invent or create a single new consonance, any more than it enables him to dispense with the consonances with which Nature has already provided him ; he enjoys his " philosophic liberty " only so long as he conforms to the natural determinations of these consonances; and the harmonic facts which arise from them and from the principle of harmony which Rameau observed to reside in musical sound itself.

Much of the criticism directed against Rameau turned on his use of the word "*natural*." Certainly Rameau did not make sufficiently clear the exact sense in which he made use of this term. He was content to state that harmony is a "natural effect" and is "derived directly from Nature." He might, of course, have pointed out that all motion in Nature is or tends and strives to become rhythmical, and therefore harmonious or musical. He might have pointed to the periodic motions of the heavenly bodies, to the regular ebb and flow of the tides, to the rhythmic surge of the waves upon the shore, to the rhythmical bodily movements of men and animals, to the accents of speech, in prose as well as in poetry, to daily human activity and intercourse, and social institutions. It is the lyre of Orpheus which, as the Greeks finely imagined, charms and sways not man alone, but all Nature. But it is not by the meaning which Rameau assigns to the word "natural" that his theory must stand or fall. The criticism directed against Rameau leaves unaffected his fundamental principles of harmony, the principles on which his whole theory is based. It remains true that "harmony does not arise arbitrarily, but from a definite principle"; further, that "this principle of harmony resides in musical sound itself."

Rameau's fundamental principles stand firm : his theoretical difficulties and failures were chiefly the direct result, not of his adherence to, but his departure from, these principles. It cannot be said that we find, among his successors, any who have been able to remove these difficulties. In treating of music and harmony as a physico-mathematical science, and of the theory of harmony in general, Rameau reveals himself as one of the greatest of musical theorists; his theoretical researches are of pre-eminent importance ; indeed, among his successors, we meet with only a few who appear to have completely grasped the full significance of his theories. In

the case of the majority of those who, following Rameau, have related harmony to acoustical phenomena, the most characteristic feature of their work is undoubtedly the extraordinary development at their hands of the principle of the generation of chords by means of added Thirds, and their still more extraordinary manipulation of the harmonic series for this purpose. It is a characteristic confined not to one country nor to one school.

In Day's work we find a Fundamental Bass consisting like Rameau's of three terms, but on different degrees of the scale, on each of which is placed, not a consonant harmony, but a gigantic discord. As from his three huge "natural discords" Day derives all the sounds which he considers to be comprised in the key-system, to say nothing of several others which are not required, and which have certainly never appeared in any known harmonic system, Day would seem to have taken the most effective precautions against being left without an explanation of any sound-combination which has ever appeared, or is likely to appear, in music. No sound-combination, it might be imagined, which could be evolved by the genius of composers but could be derived from one or the other of his "natural discords," or failing this, from two, or even all three combined. Unfortunately Day's precautions are unavailing; he finds himself unable to account for one of the only two *consonant* chords used in music, namely, the minor harmony. On the Tonic of the minor key-system we find, not a minor harmony, but a major one. Further, there is no Subdominant and no Submediant; no consonant Subdominant harmony, and no consonant Submediant harmony. It has been considered that the radical defect of Day's theory lies in its system of "roots." On the contrary, it is Day's conception, in which he follows Rameau, of a simple system of "roots," from which the complete harmonic material of the key is derived, which explains the influence his theory has exercised upon musicians. Only, our key and harmonic systems, including the whole harmonic material utilised by even the greatest masters, are much more simple than Day ever imagined. Professor Prout, having closely followed Day's system, even if, as he considered, he developed it somewhat, and having exploited the harmonic series for the purposes of his theory, suggests in the *Preface* to his new

work on harmony that the harmonic series has led him astray. He finally discards Day's system, and practically throws the harmonic series overboard. In doing so, however, he finds himself rather more badly off than he was before. He is quite unable to formulate any independent theory of harmony. Instead, he borrows theoretical ideas from various quarters. He considers that much in harmony may be explained by means of the principle of Tonality, and of the "melodic tendencies" of the sounds of the scale. In taking up this position Prout, however, meets with no better success than those from whom he has borrowed his ideas.

Against such an absurd manipulation of the sounds of the harmonic series, and the no less absurd consequences which follow therefrom, the theoretical works of Kirnberger, Hauptmann, Fétis, Stainer, and others, may be regarded in a sense as a protest and a reaction. Kirnberger, however, finds it impossible to dispense with Rameau's principles of a Fundamental Note (*Grundton*) and of Harmonic Inversion; while on each degree of the major scale he places not only a triad but a chord of the Seventh, without considering it necessary to explain where he obtains these chords, or the liberty to place them where he does. Kirnberger, after informing us that a great deal of unnecessary pother has been made over Rameau's chord of the Added Sixth, which he thinks admits of a quite simple explanation as arising from a passing-note, nevertheless avails himself of Rameau's theory of "double employment" in order to account for a Subdominant-Dominant succession of harmonies. Stainer, like Kirnberger, is of opinion that "it is time enough to found a theory of harmony on a mathematical basis . . . when practical musicians shall have framed a new system of notation which shall point out to the performer the ratio of the note he is to sound." Stainer therefore proposes a theory of harmony based on the tempered scale. But unfortunately Stainer finds it necessary to point out that this scale is "out of tune." Like Kirnberger also, Stainer cannot dispense with a "ground-note" and the inversion of chords. But, unlike Kirnberger, he has a principle of chord generation, which is that of added Thirds. On the Tonic and Dominant of both major and minor keys he erects huge structures of added Thirds. Stainer does not derive this principle of chord generation from the tempered scale, but from Day's theory.

With regard to Hauptmann, it is a matter for lasting regret that such a musician and theorist, undoubtedly one of the greatest after Rameau, should, in abandoning the solid facts of acoustical science, have imagined that he could discover a firm basis for his theory in a system of Hegelian metaphysics. Helmholtz is of opinion that Hauptmann has *needlessly* buried his valuable theoretical apperceptions under the abstruse terminology of metaphysics. But Hauptmann was well aware that, for a theory of harmony, a basis of some sort was necessary. He decided against a physical basis, and sought for his theory a metaphysical one. It is just one of the principal defects of Hauptmann's system that it has no solid basis. Hauptmann begins with the important declaration, on the truth of which he considers so much in his system to depend, that in music and harmony there are only three intervals which are "directly intelligible," namely, the Octave, Fifth, and (major) Third. But this, if true, cannot be proved by a method of dialectics. Immediately thereafter, Hauptmann finds it necessary to assume that the two sounds forming the interval of the Fifth are opposed to one another. These two sounds, however, which he has already stated to form a "directly intelligible" interval have, by all nations in possession of a musical system, and at all times, been regarded as directly related to each other in a consonant relationship. Hauptmann's declaration, supposed by German theorists to mark an important epoch in the history of the theory of harmony, is merely an echo of what had been previously stated by Rameau, namely, that the only "directly derived" intervals are those of the Octave, Fifth and major Third. Hauptmann must frequently have cast a longing glance at Rameau's extremely simple and clear method of demonstrating that these were the only intervals which arose directly from the fundamental note. It is just the principal weakness of Hauptmann's theory that it does not appear to permit of anything in harmony being regarded as "directly intelligible." Each harmonic fact can only be understood through the "mediation" of something else. Thus the sounds forming the Fifth are opposed to one another, and are only rendered "intelligible" through the "mediation" of the Third. Similarly, the Dominant-Tonic succession of harmonies (Perfect Cadence) can only be understood as brought about by the "mediation" of the triad on the Mediant.

But if there is one thing more than another in harmony which is "directly intelligible," it is the succession of harmonies in the Perfect Cadence.

The works of Dr. Riemann, who must be regarded as the foremost representative, in the domain of musical theory, of latter day German "culture," present not only an interesting theoretical but also psychological study. Dr. Riemann's theoretical methods, as we have seen, are not above criticism. Even if we leave out of account his—doubtless unintentional—misquotation of important passages from eminent theorists whose works nevertheless are but little known to the average musician, the fact remains that Riemann is not over-careful as to the means he adopts to buttress, as he imagines, his own theories. His treatment of Zarlino is a case in point. Not only has he widely disseminated statements respecting the nature of Zarlino's theory which are not borne out, but actually contradicted by the facts, but he quite fails to grasp the real significance of Zarlino's theoretical researches, and his real position in the history of musical theory.

Of his own theory of harmony, he tells us at the conclusion of his *Geschichte der Musiktheorie*, that it stands firmly and solidly on the rock of truth ("der Standpunkt, auf dem ich stehe, ein felsenfestes Fundament erhält"). This is somewhat confident language to come from a theorist who is unable to make up his mind as to what is the foundation, the fundamental note, of the minor harmony, or as to what constitutes the proper basis even of the theory of harmony, and whose principal work on harmony, *Harmony Simplified*, is characterized by the most extraordinary uncertainty and contradiction. The difficulties of the subject, as Rameau discovered, are great. But it is certain that it is not in modern German "culture" that we find their solution. Riemann's first great theoretical principle is embodied in his theory of the "tonal functions of chords." Every chord in the key-system, he states, has and must have either a Tonic, Dominant, or Subdominant "function" or significance. But Riemann quite fails to demonstrate that this is really the case. In order to support his theory, he is obliged to introduce an elaborate system of "parallel-klangs," of whose origin he is unable to give any definite explanation, and which, notwithstanding that they appear to admit of the most extraordinary harmonic metamorphoses, he still considers to possess

a Tonic, Dominant, or Subdominant "function." But in spite of the manifold and quite unrecognisable forms which the parallel-klangs may assume, Riemann presents us with several chords which he himself admits cannot be explained either by his theory of parallel-klangs or of "tonal functions." Such chords have to be understood as arising from "leading-tone steps." In reviewing Riemann's procedure in respect of his "parallel klangs" and chords arising from "leading-tone steps," one can well appreciate the force of the statement which he makes at the beginning of his work, that harmony has its roots in melody. On the other hand, it is doubtless his theory of "klang-representation," his generation of the major harmony from the harmonic series, and of the minor harmony from the "undertone series" which occasions his remark at the end of his work, that "harmony is the fountain-head from which all music flows."

Dr. Riemann's second great theoretical principle is that not only the minor harmony but also the minor key-system must be regarded as the direct antithesis of the major harmony and key-system. Yet at the beginning of his work he tells the student that in practice he had better consider the lowest note of the minor harmony to be the fundamental note. But this fact does not prevent Dr. Riemann from introducing a bewildering variety of "klangs," "over-klangs," "under-klangs," "contra-klangs," etc., into a work already sufficiently complicated by an elaborate system of "parallel-klangs." In his work *Harmony Simplified*, Dr. Riemann has made of harmony a subject of quite needless complexity.

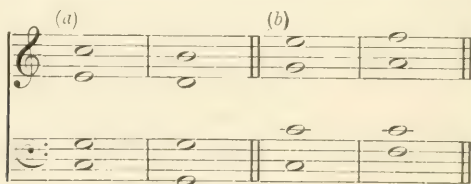
With regard to Fétis, we saw that he considers the fundamental principle of all music to be what he calls Tonality, a principle however as to whose nature he has himself only a vague conception, and of which he is unable to furnish any clear explanation. All music, according to Fétis, has as its basis or source the scale. The nature of music and harmony is determined by the order or arrangement of sounds in the scale. Change the order of sounds in the scale, and the nature of the harmony resulting therefrom becomes likewise changed. Scales are not all of one type, but are of the most varied type. Take, for example, the Chinese or other similar scales: our harmony would become impossible in such tonalities. But Fétis does not inform us whether the Chinese, or the other

nations to whom he refers, have ever attempted to make their scales the basis of a harmonic art of music. He inverts things in a curious fashion. He considers that the harmony resulting from such scales would be quite different from "our harmony," which is no doubt the case so far as the Thirds and Sixths are concerned, but which is false with regard to the consonances of the Octave, Fifth, and Fourth found in these scales. These consonances are the same in every respect as our perfect consonances. What Fétis ought to have said is that the inevitable result of the application of harmony, of the "natural" Thirds and Sixths, to the scales he mentions, would be to change the arrangement of the sounds of the scale. This, however, would make it appear that it is harmony which determines the sounds of the scale, and not the sounds of the scale which determine harmony. Fétis speaks of "our harmony." But what other kind of harmony is there? There is none, nor has there ever been any other in existence. The constituents of "our harmony" are the perfect and the imperfect consonances. The consonances of the Octave, Fifth, and Fourth in use at the present day, are the same in every respect as the consonances known in the sixth century B.C.

Fétis is quite unable to inform us where and when the scale which has determined "our harmony" came into existence. Of all the scales which were in use throughout Europe before the advent of polyphony there was not one which corresponded with our major or minor scale. If Fétis had carried his researches into the nature, history, and development of scales, and especially of the Church Modes, a little further, he would have discovered that these Modes, quite different as regards the arrangement and proportion of their sounds from our modern modes, were under the influence of harmony gradually altered until they assumed the form of our major and minor modes. It was harmony, and especially the use of the "natural" Thirds, which played the greatest part in banishing these old Modes out of existence. Fétis evidently wishes us to believe that "our harmony" has arisen through a chance combination of two or more sounds from a scale fashioned on "purely melodic principles," so as to form a series of sounds varying in pitch, and of intervals readily appreciable to the ear. That such was actually his view is confirmed by his remarks on the origin of scales in the *Préface* to his *Traité de l'harmonie*.

It is when he comes to formulate what he calls the "laws of tonality," and attempts to explain chord succession, that the real barrenness of Fétis's principle of tonality becomes apparent. What the laws of tonality really are, Fétis has only a vague idea. These laws do not appear to arise from, or to be connected with, the order of sounds in the scale, but with the fact that certain sounds in the scale have a character of repose. Only those sounds have a character of repose which admit of the harmony of the Fifth. What sounds these are, Fétis does not find it easy to determine. He first postulates the first, fourth, and fifth degrees of the scale as the sounds of repose, but afterwards finds himself obliged to admit others, especially that on the sixth degree. As for the third degree of the major scale, this is not a sound of repose, although the Fifth above this sound is a Perfect Fifth. The reason for this, according to Fétis, is that "its tonal character is absolutely antagonistic to every sense of repose."

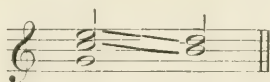
Here, the theory of Fétis appears to be not altogether unconnected with Rameau's Fundamental Bass in Fifths, the three terms of which consist of the sounds on the first, fourth, and fifth degrees of the scale. Fétis, in fact, perceives that for the different kinds of Cadence, which is the principal means used in harmonic music to produce the effect of repose, these three sounds, with their harmonies, are indispensable. Fétis knows well, also, that a Cadence may occur not only on the Tonic, but on the Dominant and Subdominant as well. But it is important to note if, in the Cadence at (a):—



we regard, as we needs must, the Dominant *g* as a note of repose, so also must we regard its Third *b* and Fifth *d*, which are sounds of its harmony. Similarly, we must consider all the sounds of the Subdominant harmony *f-a-c* at (b) to be sounds of repose. The sounds of repose in the

scale of C major are therefore *c, d, e, f, g, a, b, c'*; a fact which, however interesting it may be in itself, does not help us much towards a solution of the problems of harmony.

It is noteworthy that musicians who hold by the principle of tonality, whatever that may mean, and by the character of repose attaching to certain sounds in the scale, have not yet made up their minds as to what sounds these are. Some consider the third of the major scale, which Fétis pronounced to be absolutely antagonistic to any sense of repose, to be actually a sound of repose, while the fourth degree of the scale, which Fétis considered to be a note of repose, they describe as a leading-note, a note of unrest, which tends to fall to the note a semitone below. In a work on ear training recently published the author considers the first, third, and fifth sounds of the major scale to be the true sounds of repose; the leading-note he describes as the note of greatest unrest. But he finds himself obliged to add that in certain circumstances this leading-note may appear as a note of rest, which is of course the case. To this we might add that the notes of rest may appear as notes of unrest:—



Thus *c* and *c'*, notes of rest, are perceived to be notes of unrest, which find rest in *b* and *d*, notes of great unrest! It may be objected that it is dissonance which brings about the downward "resolution" of the sounds *c* and *c'*. But *e* is not a dissonant sound; and why should *c*, which forms a perfect Fourth with *g*, be regarded as dissonant? The real explanation, of course, is to be found in Rameau's principle of the Fundamental note. The two sounds *c* and *c'* move downward in order to form a harmonic triad on *g*. In short, the notes of rest in the scale may become notes of unrest, and the notes of unrest notes of rest, according to circumstances. These circumstances are determined by harmonic, not melodic considerations.

But all this represents only one side of the theory of Fétis. It has another side. According to Fétis, we must believe not only that it is the scale which has determined our harmony—

and our tonality, but that it is harmony which has determined the sounds of our scale. This has been brought about by the chord of the Dominant Seventh, which Fétis calls the "natural chord of the Seventh"; this chord, he says, has its source in the harmonic series, and is represented by the terms 4 : 5 : 6 : 7 of this series. It is Fétis, however, who in his works on harmony has made it his principal object to prove the absurdity of relating the theory of harmony to acoustical phenomena. Fétis is not the only musical theorist who has attempted the impossible task of running two absolutely contradictory theories side by side. What is surprising is that musicians should have accepted either of them, much less both. The widely disseminated doctrine of Fétis that our modern harmonic system has been brought about by the introduction into harmonic music of the *natural* chord of the Dominant Seventh has become almost an article of faith among musicians. Nothing has tended more to obscure the true nature of harmony and of our harmonic system. Musicians have not sufficiently considered whether it might not have been the developments resulting in our present harmonic system which made the chord of the Dominant Seventh and, in general, unprepared discords artistically possible, and gave them harmonic value and significance.

The most important part of Helmholtz's work, *The Sensations of Tone*, is undoubtedly that in which he treats of the physical properties of musical sound. When he approaches the theory of harmony, it becomes evident that something more is necessary in dealing with so elusive and subtle a subject than trained scientific perception and judgment. This "something"—intuition or genius—Rameau possessed in a marked degree. Helmholtz's statements with regard to some of the most fundamental principles of the science of harmony are marked by a curious hesitation and uncertainty. He considers that consonance is to be explained by means of the phenomenon of beats, but also suggests that the real explanation of consonance is to be found in Fourier's law. The riddle of consonance, he states, has been solved by the discovery that the ear resolves all complex sounds into pendular oscillations, according to the laws of sympathetic vibration. Again, when he treats of the origin of early scales, he finds himself obliged to make use of "natural" Thirds and Sixths, but tells us in another part of his work that such consonances were

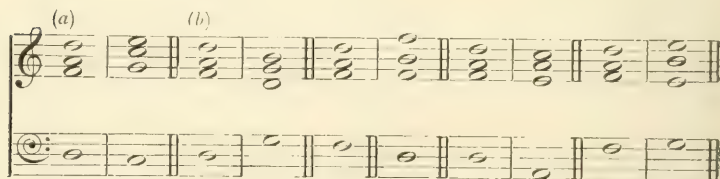
unknown until the close of the Middle Ages. In one place he tells us that it is absurd to consider that the second degree of the scale was determined by an "understood" fundamental bass at a time when harmony was unknown; in another place, that there is no other means by which this second degree can be determined and accurately intoned. If at one time he expressly states that the closest relationship existing between chords is that of the Fifth, at another he insists that the closest relationship is that of the Third, where the chords have two notes in common with each other.

Helmholtz's views as to the nature of the minor harmony, we found, were not original, but were anticipated by Rameau, followed by d'Alembert and Serre; while as for his principle of "klang-representation," considered by Dr. Riemann to be his most original contribution to the science of harmony, Rameau not only understands this principle, and explains it in the most complete way, but makes use of it for his system of the Fundamental Bass.

Like Rameau, Helmholtz is of opinion that in the natural relations to be observed in the resonance of a sonorous body, we find the proper basis of the theory of harmony. But Helmholtz does not appear to have any firmly rooted convictions on this point, and does not seem disposed, like the great French theorist, to consider such relations to constitute the fundamental principle of harmony, and of our harmonic system. Here again Helmholtz speaks with two voices, for he finally informs us that it is really in Tonality that we discover the "fundamental law" of all music, melodic or harmonic. Further, tonality, in which the principal rôle is assigned to an "arbitrarily selected" Tonic, is "not a natural law, but an æsthetical principle." The theory of harmony, then, would appear to have not a physical, but a metaphysical (psychological) basis.

It is largely owing to Helmholtz and Fétis that the doctrine of tonality has become so prominent at the present day. Now that the "root" theory, thanks to the extraordinary exploitation of the harmonic series, is falling so rapidly into discredit, tonality has become the mystic word which is to solve for us all the mysteries of harmonic science. Yet of all who make use of the term how many could give a clear answer to the question—What is tonality? Helmholtz is at least able to reply that tonality is the relationship which

the notes of the scale bear to the Tonic, and the chords of the key to the Tonic Chord. That such a relationship exists has been known for a few centuries; but the theory of harmony begins when the attempt is made to discover what exactly is the relationship which notes and chords bear to the Tonic, and to the Tonic chord. It is true that the vast majority of musical compositions begin and end on the Tonic chord, and it is quite correct to consider this as a fact of theoretical importance; but what goes on in the middle is also of considerable importance, and it is here that the principal theoretical difficulties lie. That is not an adequate harmonic analysis of a musical composition which merely points out an occasional Tonic (or even, in addition, an occasional Dominant or Subdominant) chord, which stand like harmonic oases in the midst of stretches of arid waste from which harmony seems for the time being to have disappeared. It has been thought sufficient to point out that everything in harmony gravitates towards the Tonic chord, but this does not help us to understand how so much in harmony gravitates away from the Tonic chord. It may explain why every chord should proceed at once to the Tonic chord as at (a):—



supposing that chords generally proceeded in this way, but it cannot explain the extremely simple chord successions in C major, which follow (b) and which might be multiplied almost *ad infinitum* by means of chromatic chords. "What I call Tonality," exclaims Fétis, in one of the numerous attempts he makes to define this term, "is the aggregation of facts, harmonic and melodic, presented to us in the artistic works of composers themselves." But, it is important to note, the theory of harmony begins and does not end here; it begins when we set out to discover the principles which underlie such an "aggregation of facts."

But Helmholtz, although he expressly declares that the fundamental law of all music, melodic or harmonic, is Tonality, which is "not a natural law, but an æsthetical principle," does not appear to be quite satisfied with this statement; he is also of opinion that music and harmony depend, to a certain extent, on natural acoustical law. This theory appears to be quite a feasible one, and it is needless to find fault with it so long as it is properly understood that the creative work of the musician or tone-poet is accomplished without any conscious dependence on natural or acoustical law, but solely on æsthetical principles, and that that part of music which Helmholtz considers, quite rightly, to depend on natural law, for example, the determination of the consonances, depends quite as much on æsthetical principles as any other part. When properly considered, the theory in question does not appear to have much meaning, and it is not surprising that hitherto the results of attempts to explain harmony on æsthetical principles have been disappointingly meagre, superficial, and inadequate. The application of such a theory to the simplest harmonic facts produces some curious results. Thus, while Helmholtz considers the major harmony to be determined by natural law, such is not his view of the minor harmony. It would appear then, that while we must regard the major harmony as based on a natural law, we must consider the minor harmony to arise from an æsthetical principle; or, as some theorists tell us, while the major harmony is a "natural" harmony, the minor harmony is an "artificial" one. More strictly, seeing that Helmholtz considers the minor harmony $c\text{-}e\flat\text{-}g$ to be a compound tone of c into which the "foreign" sound $e\flat$ is introduced, the sounds $c\text{-}g$ of the minor harmony $c\text{-}e\flat\text{-}g$ arise from a natural law, while the "foreign" sound $e\flat$ has its source in an æsthetical principle. We saw that Professor Prout considered himself at liberty to select, reject, or even modify, in the most arbitrary fashion, sounds from the harmonic series in order to form chords. In this he supports himself on the authority of Helmholtz, quotes the statement referred to, and gives it a prominent place at the beginning of his work. For Professor Prout, the harmonic series represents the natural law, while his selection of sounds from this series in order to form chords of the Eleventh, Thirteenth, etc., represents the æsthetical principle. Dr. Riemann,

in his *Natur der Harmonik*, considers the major harmony to arise from a natural law, but is of opinion that the minor harmony can only be explained on psychological grounds.

Again, we meet with theorists who derive a consonant harmony from the first sounds of the harmonic series, but who explain all dissonant harmonic formations as arising from "non-harmonic" notes, "chromatic alteration," and so forth. It is evident that one of the principal drawbacks of such a theory is that it is too elastic; it presents too great a temptation to the theorist, who has little difficulty in referring sounds and chords whose natural origin he can easily trace to a natural law, but all other sounds and chords, that is, all those of whose origin he is ignorant, to an æsthetical principle.

Still it is asked, has music really to do with anything external to ourselves? Is music not the expression of man's inner nature, of his sensations, emotions, ideas: is it not, therefore, in the human soul that we must discover the true source and explanation of music? Is not music man-made? It proceeds from man and will perish with him. Why not accept this fact, brush aside the cobwebs of mediæval mysticism, and give up the attempt to explain music as related in some way to the eternal laws, the Supreme Intelligences, which guide the stars in their courses? It is true that in present-day musical theory we find a marked tendency to refer many of its problems to psychology. But it is to be feared that what temperament was to an older generation, that psychology is at the present day, namely, a haven of refuge for the distressed musical theorist. When a musical theorist tells us that a certain fact admits only of a psychological explanation, it is more than probable that he has failed to discover for it any adequate explanation. It should be remembered that if the difficulties connected with the science of harmony are great, so likewise are those connected with the science of psychology, and that if musical theorists are turning to psychology to help them out of their difficulties, psychologists themselves on the other hand are searching in music and harmony, and their effects on the human organization, for the solution of problems which confront the science of psychology. Further, that music is the expression of man's inner nature does not mean that harmony cannot possibly have a physical basis.

There is, undoubtedly, a marked tendency at the present day to accept the view that all music, melodic or harmonic, has its origin in the scale. Melody, it is pointed out, existed before harmony; consequently we must regard harmony as having its roots in melody, that is, in the scale. All melodic and harmonic facts, then, are developed from the scale on purely æsthetical principles, and can admit only of a psychological explanation. But what, then, is the origin of the scale? This is a matter with regard to which much speculation has been indulged in. Helmholtz's explanations as to the probable origin of early scales are not convincing. Others are of opinion that the matter admits of a quite simple explanation. They point out that whereas the scales of man consist of a succession of degrees, of intervals of sound, the scale of nature on the other hand consists of an unbroken stretch of sound. Such a scale is useless for artistic purposes, for which a series of definite intervals is necessary. But nature does not supply us with these intervals; strictly speaking, nature furnishes us with no scale, but only with the raw material from which scales may be formed.

From the stretch of sound supplied by nature man has measured off certain intervals easily appreciable by the ear, and suitable for his artistic needs; but such a process, it is evident, admits of a quite simple psychological explanation, and has nothing to do with mathematics or acoustical phenomena. It might at first be imagined that scales formed in this way would consist of a succession of *equal* intervals. That this is not the case, but that musical scales consist of a series of intervals of different sizes, and that we find tones which differ by the extremely minute interval of a comma (80 : 81), an interval which the unaided ear could not possibly determine correctly, is no doubt to be explained by the necessity for variety of artistic material.

Fétis is able to supply us with numerous particulars as to the origin of early scales. The first scales, he states, consisted for the most part of small intervals of a quarter of a tone; these in course of time gave place to scales consisting largely of semitones, from which was eventually developed the diatonic scale, consisting mainly of tones. "The interval of a tone in music," he remarks, "can only be understood as arising from the elimination of a number

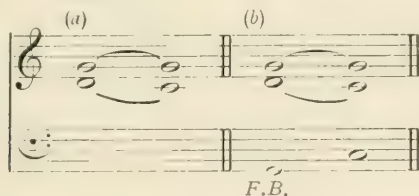
of smaller intervals, notably that of the semitone." ¹ Fétis attempts to support these views by a reference to ancient Greek scales. The facts, however, so far as we know them, appear to point to quite the opposite conclusion. The ancient enharmonic tetrachord of the Greeks (*b-c—e*) contained no quarter-tones; it was the *later* enharmonic tetrachord which comprised *two* quarter-tones and a Third. Of these quarter-tones Aristoxenus has said that "no voice could sing three of them in succession." Further, Boethius, in his *De Musica*, states that, according to Nicomachus, the most ancient method of tuning the lyre was as follows: *c—f-g—c'*, where we find a Fourth and Fifth above *c*, and a Fourth and Fifth below *c'*; while between *f* and *g* there is an interval of a whole-tone. This whole-tone interval, it is evident, is determined as the difference between the Fifth *c-g* and Fourth *c-f*. All this is only what might be expected; for it is quite natural to suppose that it was the larger intervals which at first acquired definiteness, and only subsequently the smaller intervals.

But it is all the more strange that theorists should indulge in so much speculation regarding the probable origin of musical scales, including Greek scales, and as to the principle on which their intervals were selected and determined, seeing that early writings give us the most definite information on this matter. Greek writers on music tell us plainly that the whole-tone is the difference between the Fourth and the Fifth. The Greek semitone, on the other hand, represented the difference between two whole-tones and a Fourth. The Fourth formed the basis of every species of tetrachord. The Octave constituted the limits of the complete Octave scales. The Greeks, then, derived their scales by means of a process of *tuning* in Fourths and Fifths, a process not essentially different from that by which we obtain our scales at the present day. Without some such method of "tuning" it is difficult to understand how any musical scale could be formed, much less perpetuated. These consonances of the Octave, Fifth, and Fourth, appear to have been known to all ancient peoples among whom music was cultivated; no matter what form their scales assumed; and it is quite impossible to consider that they were arrived at, among the various nations, and defined

¹ *Traité de l'Harmonie* (Preface) and *Hist. Gén. de la Musique*.

by means of the addition, the accumulation, of small intervals—the Fourth, for example, as determined by means of the addition of so many quarter-tones, or so many semitones. In the case of the Octave, such a view is manifestly absurd. As Descartes remarked, “We never hear a musical sound, without our ear being affected at the same time by its Octave.” And what is true of the Octave is true also of the Fifth, or Twelfth, of which the inversion is the Fourth.

Rameau stated that we must believe that the fundamental bass in Fifths was known to the ancient Greeks, or, at least, that their marvellous intuition had enabled them to discover its principle, for otherwise they could never have accurately determined their whole-tone. Such a statement must to some have appeared bold, to others merely foolish. It is, of course, impossible to maintain that any system of a fundamental bass was known to the Greeks. Nevertheless the Greek method of deriving the whole-tone led directly to the principle of the fundamental bass. The Greeks derived their whole-tone (8 : 9) as at (a) ; we, as at (b) :—



The only difference between the two processes is that we, in possession of a harmonic art of music, have supplied the fundamental note to both the intervals *d-g* and *c-g*. It is a remarkable fact that in the Greek method of determining the whole-tone we discover the germ of our harmonic system. Theorists do not appear to have observed this fact ; it is, nevertheless, a pregnant one for musical theory, and one which manifests in a striking way the gradual unfolding of harmonic principles, and the intimate relationship existing between various stages of musical development.

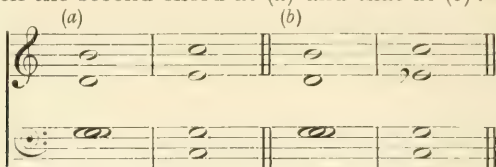
These early scales were therefore derived from the harmonies, or consonances, of the Octave, Fifth, and Fourth. The Octave defined the limits of the complete Octave scale ;

the Fourth formed the basis of the tetrachord; the whole-tone was accurately defined as the difference between the Fourth and the Fifth; while the semitone was determined as the difference between the Fourth and two whole-tones. These scales, then, had their source in harmony. It is true that we meet with theorists who object to such a view, and who impatiently inquire how scales having their source in harmony could possibly arise among nations to whom harmony was unknown. Such theorists are evidently of opinion that two sounds blending together in the consonance of the Fifth or Fourth do not constitute harmony.

The arguments so often met with respecting harmony and scales—harmony arising from arbitrary melodic combinations, from “chromatic alteration” of sounds, and so forth—are ingenious, but sophistical, and calculated to mislead those who are unable to give to the subject the necessary patient investigation and reflection. For example, there is a degree of truth in the assertion that when the cock crows, the sun rises. But it would be rash to conclude that the latter phenomenon is the necessary consequence of the former. It is frequently pointed out that among the scales of various nations, including savage races, we meet with examples of inharmonic or irrational scales, and it is argued that the mere existence of such scales is sufficient to prove the futility of relating music and harmony to natural acoustical law. As the scale is not derived from harmony, then harmony must be derived from the scale! It is true that in the rudest type of chant, the cadences, the rising and falling of the voice, furnish a not inconsiderable means of expression. Such transitions from acute to grave, and from grave to acute, may be said to constitute a scale, and in this sense all scales might be said to be originally inharmonic. But the next and the inevitable step in artistic progress is to turn this inharmonic scale into a harmonic one, *i.e.*, a musical scale, and one of the earliest of musical scales is the so-called pentatonic scale,—arrived at by means of a process of turning in perfect Fifths, as C-G-D-A-E—a scale which appears to have been in use amongst nations the most widely separated from one another. When we have satisfied ourselves that any given scale is in reality representative of a genuine musical culture, and not merely a sort of musical toy, it is necessary to exercise some degree of caution before

pronouncing judgment as to its nature. If it is to be submitted to a mathematical test, too great care cannot be taken to ascertain whether its proportions are correct. It is true that we meet with investigators, whose devotion and enthusiasm are beyond question, who are able to present us with scales of the most diverse types, the proportions of which are set forth with astonishing mathematical accuracy. One might submit that these are, if anything, too accurate. Such accuracy tends to produce some misgiving. When it is remembered that a considerable degree of skill is required for the accurate, that is, the mathematically exact intonation of even a consonant interval, where the ear is supported and guided by harmony, and indeed by Nature, it is evident that the difficulties in the way of the correct intonation (if there be really such a thing) of an inharmonic or irrational interval must be enormous, notwithstanding all that has been said with regard to the sensitiveness and delicacy of ear of savage or semi-civilized peoples. Yet even a slight divergence from the true intonation will seriously affect the mathematical result. How often does one hear a justly intoned scale, that is, a scale in perfect tune? Of the many varieties of the tempered scale, which is it that exhibits the correct proportions? And yet these scales undoubtedly represent real harmonic scales, scales which are in tune, just as most circles are meant for perfect circles. Not so many years ago it was the fashion with the interpreters of Oriental music to describe the Arabic and Persian scale as one consisting of 17 degrees, or of 16 intervals, each interval corresponding to about a third of a tone. It was customary to point out that such a scale did not at all agree with Western harmonic notions, until it was discovered from certain 14th century writings of Persian theorists themselves, that the Persian scale was arrived at by means of a perfectly systematic process of tuning in Fifths. In fact, in the folk-music which has enriched the world we discover tonal relationships much more delicate and subtle than mere differences of pitch. Such tonal relationships have their sole and ultimate basis in consonance. The whole question, in so far as it relates to our subject, can be cleared up in a word. If the scale is harmonic in its origin, then it is derived from harmony. If, on the other hand, the scale is inharmonic in its origin, then harmony cannot be derived from an inharmonic scale.

Between the second chord at (a) and that at (b):—



there is a difference of tonal effect, of "tonality." We may, if we choose, explain this difference by stating that in the first case there is a whole-tone between the second and third degrees of the scale, whereas in the second case there is a semitone. The difference of tonal effect is, therefore, owing to the different order or arrangement of the sounds of the scale. But this explanation, if it can properly be regarded as such, is worse than no explanation, because it only serves to totally obscure the truth. The true explanation, of course, is a very simple one, and, one would imagine, almost self-evident, namely, that while in the first case we have a major harmony, in the second case we have a minor one. Hence the semitone between *d-c*. It is necessary to lay stress on this point, because the arguments of such theorists, ingenious and subtle though they be, and indeed in great part because of this, completely bar the way to a proper understanding of the nature of harmony. It is all the more necessary because composers are experimenting more largely in old Modes, while every now and again we are reminded that much in our modern harmony arises out of, or is based on, a "scale of whole-tones." From J. S. Bach we have received some noble compositions, which are generally described as being in the Dorian Mode. But as Bach requires for his harmonies a major as well as a minor Seventh, and a minor as well as a major Sixth, he in reality makes use of our minor harmonic system, and of all the forms of the minor scale. The same remark applies to later composers who have imitated Bach in this respect. But in the case of old Modes which are not merely disguised forms of our major or minor modes, or are not otherwise altered beyond recognition, it should be remembered that the peculiar effect of harmonic successions within these Modes is not owing primarily to the order of sounds in the scale in which they occur, but to the peculiar nature of the harmonic successions and relationships themselves.

With regard to the "whole-tone scale," it is somewhat difficult to maintain that it has had a purely melodic origin. It cannot have been selected for its intrinsic melodic beauty. We possess, one might say, documentary evidence in the works of composers themselves that it has been developed from harmony.

The so-called whole-tone scale at (a) :—



is not in itself intelligible ; but it acquires "definiteness," or musical significance if understood harmonically, as at (b). It might of course be "harmonized" in other ways. In short, scales, chords, harmonic successions and relationships, are but different manifestations of one and the same principle. But it is by no means reassuring, so far as the proper understanding of harmony at the present day is concerned, not only that we should be so frequently informed that much of our modern harmony arises from a "whole-tone scale," but that such a scale should be described as a whole-tone scale at all. Since when did such an interval as $g\sharp-b\flat$ become a whole-tone ? One might as well describe the interval $c-g\sharp$ as a consonance, because $g\sharp$ is the same note as $a\flat$.

So far, it cannot be said that the application of psychology to the solution of the problems connected with harmony has produced any very striking results. Stumpf, in his *Tonpsychologie*, gives up the attempt to explain the phenomenon of Consonance on psychological grounds ; it must have, he thinks, a physiological explanation of some kind. Even if psychology had succeeded in solving the riddle of Consonance, it would only be at the beginning of its task, in so far as the theory of harmony is concerned. One may even venture to suggest that, at the present time, it appears to be much more likely that the science of psychology is to be advanced by the successful solution of the problems connected with a theory of harmony based on "natural principles," than that the

problems connected with harmony shall be solved by means of the science of psychology. The question as to whether music, so intimately connected with mental processes, with modifications of the human soul, has a physical basis, is one of the greatest consequence for psychology.

But why, it is objected, persist in regarding harmony as having its source in "natural principles," as determined by natural laws? Have not theorists for generations followed this road, only to find that it leads nowhere, unless indeed to a morass of confusion and difficulty? What, in reality, has music to do with mathematics or proportions? Are we, frankly, really conscious that in listening to a Third, Fifth, or other interval, such an interval corresponds to a certain numerical ratio? Especially let us not be asked to believe that the consonances were selected from any other than purely æsthetical considerations. On the contrary, how many centuries of experiment, of education of the ear, in the case of primitive peoples among whom a certain rude type of musical art was cultivated, how much apparently aimless wandering from one sound to another may have been necessary before even these simple intervals were distinguished, and the relationship existing between their sounds properly recognized and æsthetically appreciated? And in general do we not find in music, in its nature so impalpable, elusive, subjective, an art essentially different from all other arts, in that it is manifestly unrelated to objective phenomena, to anything external to itself?

Let us concede, then, that in his music-making man exercises to the full what Fétis terms his "philosophic liberty," that is, music is man-made and has nothing to do with anything external to man. This being understood, there should be noted a few facts of some importance. The first is, that early peoples, guided by their sense of the beautiful, perceived that between certain sounds heard simultaneously, or in succession, there existed a definite relationship. Here at the very outset we light on a fact of supreme importance. It is not only that this fact forms the only possible basis of a rational theory of harmony: without such relationships it is difficult to conceive how there could be any art of music, harmonic or melodic, or anything but a mere aimless wandering from one sound to another. These relationships, as Tartini pointed out, are

"independent of the human will," that is, they were not created by man for his artistic needs; they were suggested, revealed to him. He is no more able to create than he is to destroy them. One sometimes hears of "artificial" key-relationships. But a composer might as well attempt to cultivate artificial flowers as to discover artificial key or sound-relationships.

Thus were recognized the consonances of the Octave, Fifth, and Fourth, and from these the Greeks derived their scales. Greek writers themselves state that these consonances formed the basis of their tonal systems. Long before the classical period of Greek antiquity we find, among early peoples, the most extraordinary beliefs respecting the divine origin of music. Some assert that it has descended from the gods. Others, like the Egyptians, compare the sounds of their scale with the heavenly bodies, and name them after them. To Pythagoras is attributed the discovery that the consonances were determined respectively by the ratios $1:2$, $2:3$, and $3:4$. This discovery led directly to the first solid achievements in the science of harmony.

Further, the diatonic scales of the Greeks passed, under different names, into the service of the early Church. They were perpetuated throughout the whole of the Middle Ages, and were in use at the time of the rise of polyphony. During the development of polyphony, the correctness of intonation of several intervals made use of in composition, and especially the Thirds, began to be called in question by musicians. Eventually the Thirds, in these time-honoured modes, which had retained their Pythagorean tuning, had to give way to the "natural" major and minor Thirds. To the introduction of the natural Thirds may be ascribed in great measure that great artistic development, the nature of which became apparent after the death of Palestrina. They not only altered the character of the Modes—which now Zarlino himself divided into Major and Minor—but were a powerful factor in their gradual extinction, or more accurately their transformation into our major and minor modes. The essential and determining sounds of the major mode were now those which constituted a major harmony above the Final; those of the minor mode constituted a minor harmony. A considerable time before the death of Palestrina, then, the tonal system of European harmonic music had its basis in

the Perfect and Imperfect Consonances. It was discovered that the new consonant major and minor Thirds corresponded respectively to the ratios 4:5 and 5:6. Taking them in their order of perfection, the perfect consonances and the two Thirds were all expressed by the ratios 1:2, 2:3, 3:4, 4:5, and 5:6. It was Zarlino who pointed out that the consonances in question arose according to a quite definite principle—that of the *senario*, or arithmetical series, 1, 2, 3, 4, 5, 6.

Starting from the opposite direction, Zarlino arrived at a similar result. He set himself to classify the great variety of intervals which constituted the harmonic material of polyphony, and to determine whether these intervals arose arbitrarily, or from some definite principle. He first divided the intervals into two classes, consonant and dissonant. He showed that the dissonances were not in themselves intelligible, but intelligible only by virtue of the consonances which they served to retard, and into which they resolved. Of the consonances two classes also were to be distinguished, namely, simple and compound. But the latter had the same harmonic significance as the former. There remained, therefore, only the simple forms of the consonances as the essential and constitutive elements of polyphony. All, Zarlino stated, had their source in the "*senario*." The consonances did not, then, arise arbitrarily, but from a definite principle, indeed, the simplest and most definite conceivable—the series of numbers 1:2:3:4:5:6.

Zarlino did not find his path free from difficulties. Although he maintained, and as we now know quite rightly, that all the consonances had their source in the "*senario*," he was obliged to point out that all did not arise directly from this source. The two Sixths, major and minor, arose indirectly. Zarlino explained these intervals as "composite" intervals, that is, compounded of simple intervals which arose directly from the "*senario*." It was evident, however, that this explanation did not entirely satisfy him. Another difficulty was that in connection with the Fourth. The Fourth, recognized as it had been from the most ancient times as a consonant interval, was nevertheless perceived to produce frequently a dissonant effect. It had in fact, as Zarlino perceived, a dual character. There was something here, some principle in operation, which Zarlino did not fully

understand, and which he felt himself unable to fathom. Zarlino's difficulties were to lead to fresh and important theoretical results. The principle of the fundamental bass was already, and even before the time of Zarlino, making its influence felt. It had turned the Fourth, of which the lower note impressed the ear as the fundamental, into a dissonance.

Zarlino had declared that the bass was the foundation of the harmony, and in doing so he was doubtless merely expressing what had already been revealing itself to the consciousness of composers. It was a statement of much theoretical significance. But he made the mistake of imagining that the bass was the foundation of *every* harmonic combination heard above it. The mistake was a natural one, but although it represented a serious theoretical error, the consequences from a practical point of view were of no great moment at a time when the harmonies in actual use were few and simple. But during the seventeenth and beginning of the eighteenth centuries, as chords became ever more numerous, figured bass practitioners and writers on music of the time became more and more embarrassed in their attempts to systematize the new harmonic material, to reduce it to a rational order. Many expedients were tried, but without success. The only possible solution of the problem was by means of the theory of Harmonic Inversion. But the theory of harmonic inversion depended on a principle which was not realized by the figured bass practitioners, who were accustomed to regard the bass note of every chord as the fundamental note. This principle was brought to light by Rameau.

Zarlino had stated that the terms of the *senario* had their origin in unity, but he had not dared even to imagine that the *sounds* represented by these terms had their source in the first or fundamental sound. It was Rameau who made this statement, and who, startling though it seemed, demonstrated its truth. By means of his principle of the fundamental note or bass, to which is closely related that of harmonic generation, Rameau was enabled to establish his principle of harmonic inversion. The theory of the inversion of chords has been universally accepted. But we find even eminent theorists and musicians who, while accepting and utilising Rameau's theory of inverted chords, have neverthe-

less considered themselves at liberty to reject his principles of the fundamental note or bass, and of harmonic generation (of at least the major harmony) and who in general are firmly convinced that the theory of harmony has nothing to do with acoustical phenomena. This raises the question as to whether Rameau's theory of harmonic inversion, although it has been universally accepted, has at the same time been universally understood and its significance realised, especially the manner in which it affects the whole question as to whether the theory of harmony has a physical basis. Such a theory cannot be established by merely pointing to the fact that a chord and its inversions consist of practically the same sounds. The difficulty is to determine which is the "original" chord, and which the chords that are derived from it. Rameau's theory of harmonic inversion cannot be dissociated from his principles of a fundamental note, or bass, and of harmonic generation. It arises from these principles. If then harmony does not have a physical basis Rameau's theory of harmonic inversion must be abandoned. Where shall we turn for something to take its place? Certainly not to the works of any of Rameau's successors, and least of all to the "metaphysical" theories of Fétis and his disciples. It is a striking testimony to the value and adequacy of Rameau's theory of harmonic inversion that in scarcely a single work on harmony which has appeared since his time has there been even an attempt made to formulate an independent theory. Yet without an adequate theory of harmonic inversion there can be no possible theory of harmony.

But, it may be objected, if Rameau's theories of harmonic inversion and harmonic generation are so closely connected, how can the former be regarded as adequate when the latter is so evidently, so almost absurdly inadequate? This leads to a point of considerable theoretical importance. It has already been pointed out in the course of this work that of all the chords used in music one, and one only, can be directly derived from Rameau's principle of harmonic generation, namely, the major harmony. This result led Rameau to turn away from his original principle of harmonic generation, and adopt another quite opposed to the first, and in itself quite indefensible, namely, that of added Thirds. It has led not a few since Rameau's time to reject the harmonic series

as a totally inadequate basis for the theory of harmony. It has led theorists like Day, Prout, and others, to exploit the harmonic series for purposes of chord generation, and to select from this series sounds which have never formed a constituent part of any known harmonic system. The only thing which theorists who have made the harmonic series the principle of chord generation appear to have omitted to do has been to abide by the results of their own theory. Having accepted a fundamental and guiding principle of harmony, they have nevertheless refused to be guided by it, and have virtually abandoned it, or, while still professing to do it homage have vainly attempted to exploit it for their own purposes. The principle of harmony of Zarlino, Descartes, Rameau, Tartini, furnishes us with but a single chord. But this ought not to be regarded as a negative result, but as a positive result of the greatest theoretical significance. It is the one fact of supreme importance which this principle has to teach us. This has not yet been realised. Theorists have long enough rejected it because it did not conform, but was opposed to, their preconceived notions as to what was fit and proper with regard to harmony and its theory. There exists in our harmonic music but a single chord, from which all others are developed.¹ But as the sounds of this harmony are contained in the resonance of musical sound itself, all harmony has its source in a single musical sound. The development of harmony has been a more simple and beautiful process than musicians and theorists have imagined.

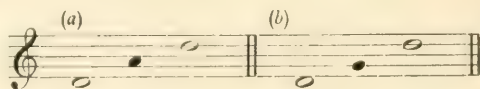
In laying the foundations of the science of harmony, Rameau builded better than he knew. He did not for example perceive that the minor Sixth, like the Fourth, quite apart from its position within the key-system, had a dual aspect, or if he did he was unable to advance any explanation of this fact, although the explanation lay within his grasp. Of the dual nature of the Fourth he was quite aware, but explained it wrongly. The Fourth when consonant, he stated, represents the inversion of the Fifth; but when dissonant, it

¹ Our examination of various theories of harmony in the course of this work will have helped the reader to understand, to some extent at least, how this can be the case. The writer may be permitted to state that he hopes to complete shortly a new and smaller constructive work on the theory of harmony, the materials for which he has already prepared.

represents not a Fourth but an Eleventh, and must be regarded as the highest sound of what is sometimes called the "chord of the Eleventh." This explanation has been advanced by not a few theorists since the time of Rameau.

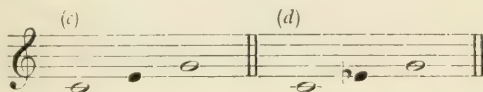
Zarlino had discovered that the complex of consonances comprised in the *senario*, when sounded simultaneously, resulted in a "most perfect harmony." This *Harmonia Perfetta*, which represented the consummation of Zarlino's labours in the classification of the harmonic material of his time, as well as the labours, from a harmonic point of view, of the entire polyphonic period which reached its climax in the sixteenth century, formed the starting-point of a new musical epoch. After the publication of his *Traité* Rameau discovered, to his astonishment, that the fundamental principle of harmony which he had received from Zarlino actually existed, so to speak, in the flesh. Rameau's astonishment that what he and others had recognised to be a rational necessity should actually exist as a fact in nature, arose in great measure from his having perceived such a fact for the first time. In reality, however, it was the natural manifestation of a principle which had existed from the beginning of things. When primitive peoples affirmed that their music had originally descended from the gods, there were doubtless philosophers of the time in whom such a belief excited not reverence, but ridicule. The discovery of Pythagoras that the harmony of his time had its source in the series 1 : 2 : 3 : 4 may have given such philosophers food for thought. But now, as Rameau points out, this principle of harmony reveals itself in nature as an actually existing fact. In his *Nouveau Système* he remarks that "those who refuse to believe their ears may at least accept the evidence of their eyes"; and also points out that one may in addition convince himself through the sense of touch, by placing his finger on the nodes of the vibrating string.

As is known, the Church Modes were divided into two main classes, Authentic and Plagal. The Authentic mode (*a*) was considered to consist of a Fifth and a Fourth: the Plagal (*b*) :



of a Fourth and a Fifth. In making these distinctions, musicians were undoubtedly guided by their sense of what was artistically appropriate and beautiful, and not by theoretical or mathematical considerations. Nevertheless, Glarean¹ pointed out that the division observed in the Authentic mode was neither more nor less than the harmonic division of the Octave ($2 : 3 : 4$), while that in the Plagal mode arose from the inversion of this division.

In our Major and Minor Modes, on the other hand, the determining sounds are the first, third, and fifth of the mode. Zarlino, going a step further than Glarean, demonstrated that the determining sounds of the major mode (which constitute a major harmony) arise from the harmonic division of the Fifth ($4 : 5 : 6$) (*c*) :—



those of the minor mode (which constitute a minor harmony), from the inversion of this division (*d*). Our major and minor modes have taken the place of the authentic and plagal modes of a former epoch. The Octave, the consonances arising from its harmonic division and that of the Fifth, form the sole constitutive elements of harmonic music.

In all this a consistent and beautiful development may easily be traced. From the earliest beginnings of the art of music, and underlying the whole course of its development, a single principle may be observed, steadfast and invariable.

It has been argued that the consonant intervals were selected by man from a large variety of sound-combinations as those most suitable for his artistic needs ; that they were arrived at only after long periods of testing and experiment ; that, in short, the appreciation and recognition of these intervals as consonant was the result of a long process of education of the ear. There are certainly grounds both physiological and psychological for such a view. The history of the major and minor Thirds would appear to confirm it. These were arrived at only after long experiment. But it

¹ See p. 48.

would be a decided mistake to imagine that in his searchings, wanderings, even blunders, man was left wholly to himself. He had a guide. In every musical sound that he produced, the principle of harmony was revealing itself to him. When at last he discovered the consonances most suitable for his artistic needs, it was found that they were none other than those which this natural principle had all along suggested to him.

These are important considerations for the theory of harmony, and not for the theory of harmony alone. What, then, may we infer from them? We may at least infer that this natural manifestation, this principle of harmony, has been and is, to make use of the felicitous expression of Rameau, "*the invisible guide of the musician.*" Long enough have theorists professed to do it homage, while actually engaged in vain attempts to exploit it. In so far as the theory of harmony is concerned, the way may be difficult. Still, it is the way.

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